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TECHNICAL APPENDIX ON INDUSTRIAL WASTE-SOURCE EVALUATIONS, WATER QUALITY INVESTIGATIONS IN THE SOUTH PLATTE RIVER BASIN, COLORADO, 1971-72

National Field Investigations Center
Denver, Colorado

June 1972

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Forty-four industrial plants were visited in order to ascertain water pollution control practices. Twenty-two of the plants were selected for in-plant sampling to determine both the waste loads discharged and the adequacy of present water pollution control practices. Each report includes an introduction, water treatment facilities, conclusions, plant evaluation and findings, summary and conclusions and recommendations.

17. Key Words and Document Analysis. 17a. Descriptors

* Water pollution - industrial wastes
* Water quality data

17b. Identifiers/Open-Ended Terms

* South Platte River Basin

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ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT

TECHNICAL APPENDIX
ON
INDUSTRIAL WASTE-SOURCE
EVALUATIONS

WATER QUALITY INVESTIGATIONS
IN THE
SOUTH PLATTE RIVER BASIN, COLORADO
1971-72

NATIONAL FIELD INVESTIGATIONS CENTER-DENVER
AND
REGION VIII
DENVER, COLORADO
JUNE 1972

TABLE OF CONTENTS

Section	Page
GLOSSARY OF TERMS	iii
INTRODUCTION	1
ADOLPH COORS COMPANY	3
AMERICAN SMELTING AND REFINING COMPANY	11
CITY OF DENVER ASPHALT PLANT	15
CONTINENTAL OIL COMPANY DENVER REFINERY	19
GATES RUBBER COMPANY	25
GREAT WESTERN SUGAR COMPANY	
Brighton, Colorado	29
Eaton, Colorado	37
Fort Morgan, Colorado	47
Johnstown, Colorado	55
Longmont, Colorado	65
Loveland, Colorado	73
Sterling, Colorado	81
LOVELAND PACKING COMPANY	87
MARTIN MARIETTA CORPORATION	91
MONFORT OF COLORADO PACKING COMPANY	95
PUBLIC SERVICE COMPANY OF COLORADO	99
REFINERY CORPORATION (TENNECO OIL COMPANY)	105
SIGMAN MEAT COMPANY, INCORPORATED	109
WELD COUNTY BY-PRODUCTS COMPANY	113
SUMMARY OF INDUSTRIES VISITED AND NOT SAMPLED	117
Brannan Sand and Gravel Company (Pit #1), Commerce City	117
Buckley Air National Guard Station, Arapahoe County	117
Burlington Northern Railroad, Incorporated, Denver	117

TABLE OF CONTENTS (continued)

Section	Page
SUMMARY OF INDUSTRIES VISITED AND NOT SAMPLED (cont'd) . .	118
Carnation Milk Company, Johnstown	118
Centennial Race Track, Littleton	118
Colorado School of Mines Research Institute, Golden	119
Eastman Kodak Company, Windsor	119
Farr Farms Feedlot, Greeley	120
Fitzsimons Army Hospital, Aurora	120
Flatiron Sand and Gravel Company, Fort Collins . . .	121
Floyd Haag Sand and Gravel Company, Loveland	121
Gates Cyclo Poultry Farm, Brighton	122
Koppers Company, Incorporated - Forest Product Division, Westminster	122
Kuner Empson Company, Brighton	123
Lester Jones Sand and Gravel Pit, Denver	124
National By-Products Company, Denver	124
Power Engineering Company, Denver	125
Stapleton International Airport, Denver	125
Superior Sand and Gravel Company, Commerce City . . .	126
Western Paving and Construction Company, Westminster	126
Windsor Packing Company, Windsor	126
RECOMMENDATIONS	127

GLOSSARY OF TERMS

BOD - Biochemical Oxygen Demand, 5-Day

COD - Chemical Oxygen Demand

CSF - Concentrated Steffan Filtrate

DO - Dissolved Oxygen

Kj-N - Kjeldahl Nitrogen as Nitrogen

LWK - Live Weight Killed

MPN - Most Probable Number

NH_3-N - Ammonia as Nitrogen

NO_2-NO_3-N - Nitrite Nitrate Nitrogen

Total P - Total Phosphorus

SS - Suspended Solids

TOC - Total Organic Carbon

WTP - Wastewater Treatment Plant

RM - river mileage (e.g. 311.1/6.7) with first number denoting distance from mouth of the South Platte River to the confluence with a tributary stream, and second value indicating distance upstream of mouth of the tributary stream

cfs - flow rate given in cubic feet per second

gpm - flow rate given in gallons per minute

mgd - flow rate given in million gallons per day

mg/l - concentration given in milligrams per liter

µmhos/cm - unit of specific conductance (mho -- the inverse of the standard unit of electrical resistance, the ohm) measured over a 1-centimeter distance, conventionally made at 25°C

ppb - parts per billion

INTRODUCTION

This appendix summarizes information concerning industrial waste sources investigated in the South Platte River Basin and supplements the main report entitled, "Water Quality Investigations in the South Platte River Basin, Colorado, 1971-72."

Forty-four industrial plants were visited in order to ascertain water pollution control practices. Twenty-three of these plants were selected for in-plant sampling to determine both the waste loads discharged and the adequacy of present water pollution control practices. Included in this appendix is a report on each industrial plant visited with the exception of the Great Western Sugar Company mills at Greeley and Ovid. These plants are discussed in separate reports entitled, *Effects of Waste Discharges on Water Quality of the Cache la Poudre and South Platte Rivers, Greeley Area* and *Investigations of the Effects of the Waste Discharges from the Great Western Sugar Mill at Ovid, Colorado on Water Quality Conditions in the South Platte River.*

The format used for those industries where in-plant sampling was conducted is as follows:

A. Introduction -- includes background information and contacts;

B. Waste Treatment Facilities -- includes type of system, number and sizes (where information was available) of units;

C. Discussion of Plant Evaluation and Findings -- includes information on evaluation procedure, data from chemical and bacteriological analyses, visual observations, etc.;

D. Summary and Conclusions;

E. Recommendations

Summary paragraphs are included on those industries visited but not sampled.

The waste treatment requirements recommended for an industry are based on the following criteria:

1. Expected low flows in the receiving stream, as determined by an examination of available flow records;

2. Compliance with applicable water quality standards;

3. Waste-load limits achievable by the installation of best practicable treatment technology currently available.

ADOLPH COORS COMPANY
GOLDEN, COLORADO 80401

A. GENERAL

The Adolph Coors Company operates a brewery, an aluminum can plant, and a ceramic plant. Approximately 2,800 people are employed in these plants. The brewery operates continuously and produces 9,000,000 barrels of beer per year. Raw materials used include barley, rice, and hops.

Wastewater from the brewery, the can and ceramics plants and the City of Golden are treated in the wastewater treatment plant that is owned and operated by the Adolph Coors Company. In 1964 studies by the South Platte River Basin Project[1,2/] indicated that this plant was providing adequate treatment and disinfection. The BOD of the effluent discharged was 30 mg/l.

Studies on the ceramics plant[1/] indicated that adequate treatment was not provided; in 1964 wastewater (approx. 35,000 gpd) containing an average of about 3,100 mg/l of suspended solids was being discharged to Clear Creek via Tucker Gulch. It was recommended at that time that the effluent be discharged into the municipal sewer.

Water pollution control practices were evaluated by the National Field Investigations Center-Denver (NFIC-D) personnel February 3 through 5, 1972. Howard Lewis, an environmental control engineer, and Gary Downing, a sanitary engineer, provided assistance and information.

B. WATER SUPPLY AND USES

Water is obtained from three sources. These include springs (approx. 3.7 mgd), the City of Golden (0.01 mgd), and Clear Creek

(23 mgd). The spring water is used for beer, the city water for boiler feed and cooling, and Clear Creek water for cooling.

C. WASTE SOURCES AND TREATMENT

Cooling water from the brewery (22 mgd), boiler blowdown (300 gpd), sand filter backwash water (up to 8,000 gpd), and two small flows of unknown origin are discharged, without treatment, to Clear Creek, upstream of the Coors treatment plant. These discharges and the flow in Clear Creek are diverted for agricultural use during the irrigation season.

All other wastewaters from Adolph Coors Company, together with those from the City of Golden and a railroad maintenance garage, are treated at the Coors treatment plant. Wastewaters from the ceramic plant and the railroad garage receive pretreatment prior to being discharged to the plant operated by the Coors firm.

This plant, designed for an average flow of 6 mgd with an influent BOD loading of 30,000 lb per day, consists of the following:

1. Preliminary treatment -- including grit removal, bar screens, and comminutor.
2. Primary treatment -- one clarifier with a volume of 638,000 gal.
3. Secondary treatment -- mechanical acration with 24 turbines (volume of 2.5 million gallons) and two final clarifiers with a combined volume of 1.2 million gallons.
4. Disinfection -- chlorination in the contact chamber with a detention time of 15 min at a flow of 6 mgd.

Polymers are employed as additives in the primary clarifier to aid in settling. Sulfuric acid is used to neutralize cyanide wastes from the

aluminum can plant. The effluent from the treatment plant enters Clear Creek approximately one mile downstream from the main Coors plant at RM 15.4.

An expansion program is presently underway to increase the efficiency of the treatment plant. This program includes the addition of a new grit chamber and surge tank; improved chlorination facilities; conversion to pure oxygen in the aeration tanks; and addition of vacuum filtration for sludge handling. After October 1, 1972, only brewery wastes will be treated in the upgraded Coors wastewater treatment plant. All other wastewaters will be transported to the Metropolitan Denver Sewage Disposal District No. 1 plant (Metro) by means of a new interceptor.

D. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

The waste-source survey at the Coors wastewater treatment plant was conducted February 3 through 5, 1972. Two 24-hr composite samples (composited on a flow weighted basis) were collected from the influent and effluent (after chlorination) with SERCO automatic samplers. Grab samples were collected from the effluent and analyzed for chlorine residual and densities of total and fecal coliform bacteria. Temperature, pH, and conductivity were also measured periodically.

The daily discharge of BOD, COD, and SS in the effluent was 7,930 lb, 8,190 lb, and 729 lb, respectively [Table 1]. The fecal-coliform bacteria levels in the effluent numbered from 4 to 2,600/100 ml [Table 2]. The data indicate that the plant was organically overloaded and not providing adequate treatment. During the February survey the BOD-removal efficiency ranged from 69-90 percent.

TABLE 1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
COORS WASTEWATER TREATMENT FACILITY
GOLDEN, COLORADO
FEBRUARY 4-5, 1972

Parameter	Influent		Effluent		Percent Removal
	Range	Average	Range	Average	
Flow (mgd)			4.13-5.42	4.79	
pH	6.6-9.6		6.9-7.5		
Temperature (°C)	15-20		9-14.5		
Conductivity (μmhos/cm)	900-1,800		400-1,950		
BOD_5 (mg/1)	840-1,200	1,020	118-262	190	69-90
COD (mg/1)	1,220-1,280	1,250	200-213	206	83-84
Total Solids (mg/1)	1,260-1,380	1,320	800-839	820	
Suspended Solids (mg/1)	316-324	320	10-24	17	92-97

TABLE 2

SUMMARY OF BACTERIOLOGICAL RESULTS
COORS WASTEWATER TREATMENT FACILITY
GOLDEN, COLORADO

Date	Time	Total Coliform Count/100 ml	Fecal Coliform Count/100 ml	Chlorine Residual mg/l
February 3, 1972	0830	300	24	0.1
	1025	23,000	980	0.4
	1440	110,000	2,600	0.0
February 4, 1972	0825	1,300	4	0.4
	1155	34,000	1,300	0.3

As noted earlier, after October 1, 1972, only brewery wastes will be treated by this facility. Under the Refuse Act Permit program waste loads have been proposed for this plant. These loads, based on "best treatment" practices for breweries, are:

1. BOD and suspended solids, each not to exceed 53 lb/1000 bbl of beer produced, equivalent to 30 mg/l.
2. COD - not to exceed 133 lb/1000 bbl.
3. The fecal-coliform bacteria densities in the effluent not to exceed 1000/100 ml.

Irrigation diversion records show that, during certain periods, the entire Clear Creek flow is diverted upstream of the treatment plant discharge. Thus, the flow in Clear Creek consists of treatment plant effluent. Clear Creek, a tributary to a navigable stream, is classified (Colorado Water Quality Standards) as suitable for municipal and industrial water supply (Class A and C), respectively, and for irrigation (Class D). The standards specify that fecal-coliform bacteria densities in Class A waters "shall not exceed a log mean of 1000/100 ml or exceed 2,000/100 ml in more than 10 percent of the samples collected in any 30-day period." To prevent violation of the above standards the Coors Company will be required to produce an effluent that meets the criteria proposed for the Refuse Act Permit.

E. SUMMARY AND CONCLUSIONS

1. The BOD treatment level was not adequate. Efficiency of BOD-removal went down to levels as low as 69 percent. The Coors wastewater

treatment facility has been discharging to Clear Creek a BOD waste-load that has increased 11 times since 1964. An effluent containing 53 lb each of BOD and suspended solids/1000 bbl or 1450 lb per day of each, and 133 lb COD/1000 bbl or 3600 lb per day is achievable through the installation of "best treatment" technology.

2. After October 1, 1972, only brewery process wastes will be treated in this plant. All other wastewaters will be diverted to the Metro treatment plant.

F. RECOMMENDATIONS

It is recommended that conditions for the U. S. Army Corps of Engineers Refuse Act Permit for the Adolph Coors Company brewery include the following limits:

1. The BOD and suspended solids, each, shall not exceed 53 lb/1000 bbl of beer produced or 1450 lb/day of each, whichever is less.

2. The COD shall not exceed 133 lb/1000 bbl of beer produced or 3300 lb/day, whichever is less.

3. The fecal coliform bacteria density in the effluent shall not exceed 1000/100 ml.

G. REFERENCES

1/ *A Study of Industrial Waste Pollution in the South Platte River Basin*, PR-6B, U. S. Department of the Interior, Federal Water Pollution Control Administration, South Platte River Basin Project. Denver, Colorado. December 1966.

2/ *Municipal Waste Report, Metropolitan Denver Area, South Platte River Basin*, PR-3, U. S. Department of Health, Education, and Welfare, Public Health Service, Division of Water Supply and Pollution Control, South Platte River Basin Project. Denver, Colorado. December 1965.

AMERICAN SMELTING AND REFINING COMPANY
495 EAST 51ST AVENUE
DENVER, COLORADO

A. GENERAL

In extracting cadmium, thallium, and indium from smelter bag-house by-products (received from smelter operations in Mexico and Texas), the American Smelting and Refining Company refines about 6.6 tons of raw metals per day. Metals are leached with sulfuric acid and purified by electrolysis on aluminum cathodes. No attempt is made to recover the impurities (zinc, lead, and copper) from the process. The Company operates the plant continuously and employs 138 persons.

Water, obtained from the City of Denver (70,000 gpd) and the Farmer's Irrigation Ditch (140,000 gpd), is used for cooling, boiler feed, process water, and domestic purposes.

Water pollution control practices at the Company were evaluated by personnel of the National Field Investigations Center-Denver (NFIC-D) on September 28 and 29, 1971. Max Coats, Company manager, provided assistance and information.

B. WASTE SOURCES AND TREATMENT

Process wastewater and floor washings are neutralized with spent carbide in a batch operation and then discharged to a holding pond. A ditch around this holding pond collects seepage and surface runoff and empties into a storm sewer, at 51st Avenue and Pearl Street; the flow subsequently enters the South Platte River at RM 314.5. The Company has applied for a U. S. Army Corps of Engineers Refuse Act Permit for this discharge.

C. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

A grab sample was collected daily, on September 28 and 29, 1971, from the drainage ditch at the point of entry to the storm sewer. Analyses were conducted of COD, TOC, SS, and heavy metals [Table 1]. The pH, temperature, and conductivity were also measured. Based on data in the Refuse Act Permit application, the flow is approximately 0.11 mgd.

Wastewaters being discharged to the South Platte River contain only negligible amounts of contaminants. The pH of 9.0, however, is high. The volume of flow is small. No detrimental effects should occur to the South Platte River.

D. SUMMARY AND CONCLUSIONS

The small amounts of pollutants discharged by this plant should have little adverse effect on the receiving waters.

TABLE 1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
AMERICAN SMELTING AND REFINING COMPANY
SEPTEMBER 28-29, 1971

Parameter[a]	Average	Range
Flow (mgd)	0.11[b]	
pH (S.U.)		9.0-9.1
Temperature (°C)		15-16
Conductivity (µmhos/cm)		650-700
TS	415	400-430
SS	45	30-60
Cyanide	<0.02[c]	
COD	25[c]	
TOC		<5-<10
Heavy Metals		
Cadmium	0.08	0.01-0.15
Chromium	<0.02[c]	
Copper		<0.02-0.02
Lead	<0.05[c]	
Zinc	0.20	0.11-0.29

a/ All units of measurement are in mg/l unless otherwise noted.
b/ This flow value is obtained from Corps of Engineers Permit application.
c/ Both values were identical.

CITY OF DENVER ASPHALT PLANT
3600 FOX STREET
DENVER, COLORADO

A. GENERAL

The City of Denver Asphalt Plant produces a paving material by drying wet aggregate and mixing it with asphalt. The plant operates approximately 40 hours per week producing up to 1,200 tons/day (930 tons/day during the survey) of paving material.

Water, obtained from the City of Denver (approx. 32,000 gpd) is used in scrubbers to remove dust particles that are produced during the drying of aggregate.

Water pollution control practices were evaluated by personnel of the National Field Investigations Center-Denver (NFIC-D) on September 28 and 29, 1971. Albert Cavarra, plant manager, provided assistance and information.

B. WASTE SOURCES AND TREATMENT

Wastewater from the scrubbers flows to a settling basin (8 ft x 3 ft x 8 ft). The flow rate was approximately 32,000 gpd -- during the survey. The effluent from the settling basin is discharged through a storm drain to the South Platte River at RM 316.14. Since the time of the 1971 survey the effluent from the settling basin has been connected to the municipal sewer, thus eliminating this discharge to the South Platte River.

C. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

Grab samples of the wastewater discharged to the South Platte River were collected on September 28 and 29, 1971. The pH, temperature, and

conductivity were measured both times samples were collected. Based on Denver Water Department records, the flow was 0.032 mgd.

Visual observations indicated that a potential pollution problem may exist with the use of diesel fuel at this plant. Fuel is used to wash equipment and coat truck beds in order to prevent asphalt from sticking to the bed. During these operations a large amount of diesel fuel is spilled. Spills in the plant area drain to the settling pond and then to the river. No provisions have been made to remove accumulated diesel fuel from the pond.

Analyses of the effluent samples [Table 1] show that high levels of suspended solids (2260 mg/l) were being discharged to the river.

D. SUMMARY AND CONCLUSIONS

During the time of the survey large amounts of suspended solids (2260 mg/l) were being discharged to the South Platte River. This problem has been corrected inasmuch as all wastewaters are now being discharged to the municipal sewer.

TABLE 1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
CITY OF DENVER ASPHALT PLANT
SEPTEMBER 28-29, 1971

Parameter[a/]	Average	Range
Flow (mgd)	0.032	
pH		6.5-6.7
Temperature (°C)		12-15
Conductivity (µmhos/cm)		360-500
Oil & Grease	<1[b/]	
TS	3,850	1,860-5,840
SS	2,260	1,400-3,170

a/ All units of measurement are in mg/l unless otherwise noted.
b/ This value is based on one sample.

CONTINENTAL OIL COMPANY
DENVER REFINERY
5801 BRIGHTON BOULEVARD
COMMERCE CITY, COLORADO 80022

A. GENERAL

The Continental Oil Company operates a refinery and an asphalt plant at its Commerce City facility. About 155 persons are employed at the refinery, 25 at the asphalt operation.

In operating continuously, the refinery produces propane, butane, gasoline, kerosene, "Jet-50" oil, diesel oil, and other petroleum products. This operation produces 30,000 bbl per day. The raw materials employed include crude oil, caustic soda, sulfuric acid, tetraethyl lead, lime, ethylmercaptan, chromates, zinc, and phosphates. Rhenium is used as the reforming catalyst. Water for cooling-water is obtained from both wells and the City of Denver.

The asphalt plant processes heavy oil to yield asphalt and fuel oil, with the "light" ends being sent to the refinery. The asphalt plant operates continuously to produce 8,000 bbl of asphalt per year. Well water is used for both cooling and steam.

This industry was evaluated in 1964.[1/] At that time wastewater discharged into Burlington Ditch contained an average of 700 ppb phenol and 3.4 mg/l of trivalent chromium. It was recommended through the Enforcement Conference that the Company provide additional treatment to reduce phenol concentrations to 25 ppb and to remove chromium from the effluent before June 1, 1967.

Water pollution control practices were evaluated by personnel of the

National Field Investigations Center-Denver (NFIC-D) on September 22 and 23, 1971. Chief Refinery Chemist Hinton Dillard provided assistance and information.

B. WASTE SOURCES AND TREATMENT

At the asphalt plant, condensate from the steam stripper flows through a small oil separator, combines with cooling-water and storm runoff, and passes through a second oil separator. Approximately 60 percent of the effluent is recycled through the cooling towers, with the excess (about 100 gpm) receiving additional treatment (described in the following paragraph). Oil from both separators is reclaimed.

At the time of the 1971 survey the excess flow from the second oil separator was discharged into a plastic-lined holding pond. The effluent from this pond passed through two straw filters and was then discharged into Sand Creek. According to Company officials, the holding pond and straw filters have now been abandoned; the excess wastewater flow from the oil separator presently being discharged into the refinery wastewater treatment system.

Process- and cooling-waters from the refinery flow through two API separators (one having two compartments) and combine with the storm sewer discharge (if any) and with the effluent from the asphalt plant [Figure 1].

"Sour water," from a catalytic process at the refinery, is first steam-stripped in order to remove sulfides. It then flows to a bio-pond. The effluent from the pond combines with the effluent from the API separators.

The total combined flow (API, asphalt plant, storm sewer, and pond

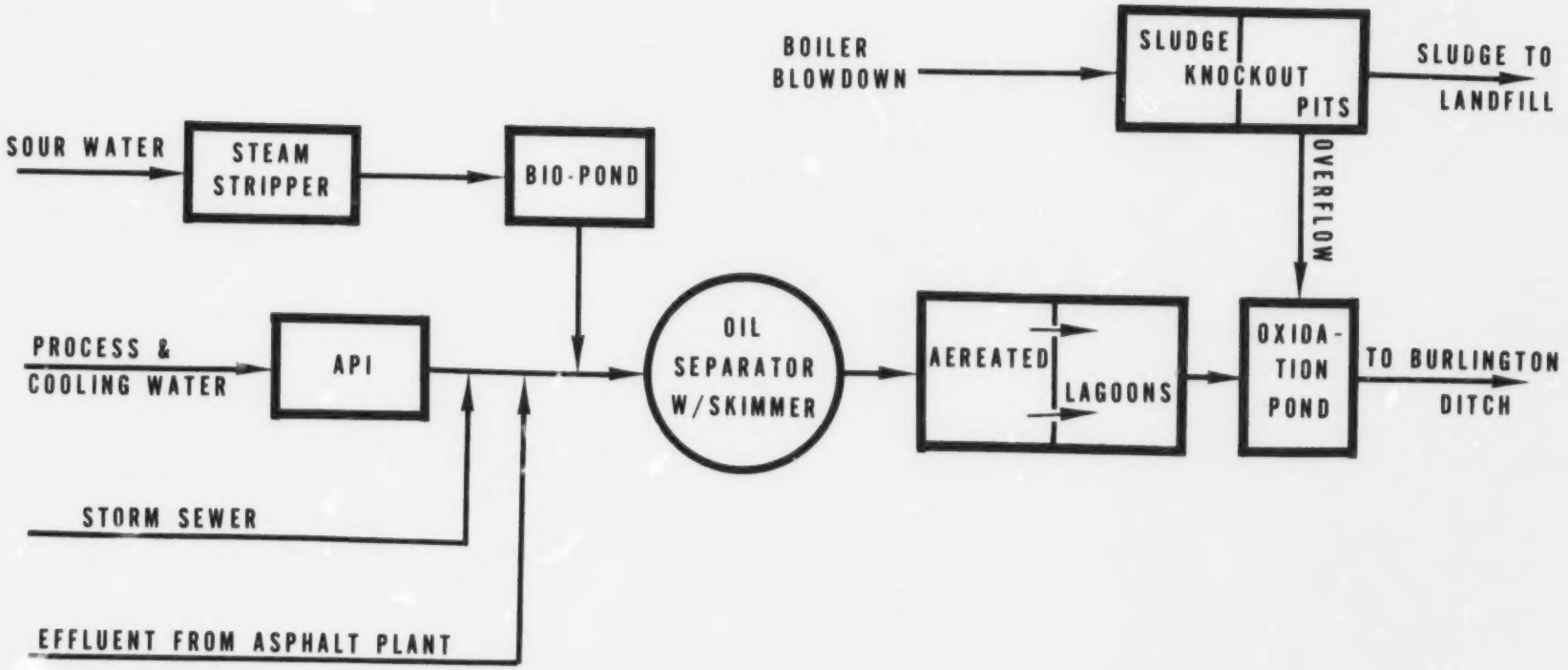

Figure 1. Continental Oil Company Refinery Wastewater Treatment Plant

effluents) enters a large separator (75 ft in diameter and 5 ft deep). The effluent from the separator then enters a series of three lagoons. The first two lagoons are equipped with surface aerators: the third lagoons are equipped with surface aerators; the third lagoon acts as a sedimentation basin. Baffles have been installed at the point of discharge from the last lagoon in order to prevent accidentally spilled oil from entering the receiving waters (Burlington Ditch).

Boiler blowdown wastes are discharged into two large sumps (approx. 6-hr detention time) where solids are precipitated and removed to a sanitary land-fill. The effluent from the sumps is discharged directly into the third lagoon.

C. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

In the sampling program, two 24-hr composite samples were collected manually on September 22 and 23, 1972. These were composited on an equal-volume basis. The pH, temperature, and conductivity were measured each time a sample was collected. The flows were estimated by Company officials.

The summary data indicated that the effluent contained concentrations of phenol as high as 130 mg/l [Table 1], a value exceeding the recommended limit* of 25 mg/l. The effluent also contained a small amount of chromium (0.72-0.76 mg/l), exceeding the recommendation* of no chromium.

As noted previously, the configuration of treatment measures has been changed by the Company since the time of the 1971 in-plant survey. Combined effluents from the asphalt plant and the refinery are discharged

* These values were recommended by *The Conference in the Matter of Pollution in the South Platte River Basin* in the State of Colorado.

TABLE 1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
CONTINENTAL OIL COMPANY
COMMERCE CITY, COLORADO
SEPTEMBER 22-23, 1971

Parameter[a]	Asphalt Plant		Refinery			
			Influent		Effluent	
	Range	Average	Range	Average	Range	Average
Flow (mgd)		0.172				0.576
pH	7.3-7.8		8.7-9.3		7.1-8.0	
Temperature (°C)	25.5-28.0				20.0-26.0	
Cond. (umhos/cm)	950-1,400		1,600-2,700		1,400-2,100	
Oil & Grease	<5-10	<5	9-120	48	3-9	4
Total Solids	660-710	685	1,280-1,450	1,360	1,220-1,390	1,300
SS		20[b]		60[b]		60[b]
TOC	5-7	6	30-40	35		20
COD		50[b]		155[b]		110[b]
Phenol (µg/l)	180-600	390	1,500-1,900	1,700	<10-180	<95
Metals						
Cadmium		<0.01[c]		<0.01[c]		<0.01[c]
Chromium		<0.02[c]	1.7-2.2	2.0	0.72-0.76	0.74[c]
Copper	<0.02-0.03	<0.025	<0.02-0.02	<0.02		<0.02
Lead		<0.5[c]		<0.05[c]		<0.05[c]
Zinc	<0.01-0.02	<0.015	0.39-0.45	0.42		0.19[c]

a/ All units of measurement are in mg/l unless otherwise noted.
b/ This value is based on one sample.
c/ All values are the same

to Burlington Ditch. The present loads discharged to Burlington Ditch and their effects on the quality of receiving waters are not known at this time. Burlington Ditch overflows into Sand Creek downstream from the point of discharge from Continental Oil Company.

Waste loads discharged by Continental Oil Company should be limited in accord with "best treatment" practices for a Class D refinery. The daily loads discharged to Burlington Ditch should contain no more than 1,575 lb of COD; 80 lb of oil and grease; 1.5 lb phenol; 310 lb of SS; 160 lb of ammonia; and 1.6 lb of total chromium.

D. SUMMARY AND CONCLUSIONS

1. The average phenol and chromium concentrations observed were in excess of those levels attainable by "best treatment."

2. The asphalt plant is currently discharging all its wastewater into the refinery treatment system. Although this will eliminate the direct discharge of waste loads to Sand Creek, it will increase the loads discharged into Burlington Ditch. Wastes discharged by Continental Oil Company will continue to reach Sand Creek because Burlington Ditch overflows into the creek downstream from the discharge.

E. RECOMMENDATIONS

It is recommended that:

1. The Continental Oil Company obtain a Refuse Act Permit.

2. The daily effluent load discharged to Burlington Ditch by Continental Oil Company shall contain no more than 1,575 lb of COD; 80 lb of oil and grease; 1.5 lb of phenol; 310 lb of suspended solids; 160 lb of ammonia; and 1.6 lb of total chromium.

F. REFERENCE

1/ *A Study of Industrial Waste Pollution in the South Platte River Basin*, PR-63, U. S. Department of the Interior, Federal Water Pollution Control Administration, South Platte River Basin Project. Denver, Colorado. December 1966.

CATES RUBBER COMPANY
999 SOUTH BROADWAY
DENVER, COLORADO

A. GENERAL

The Gates Rubber Company, sixth largest rubber processor in the United States, manufactures tires, commercial and industrial hoses, and drive belts. The raw materials used include rubber (natural, synthetic, and reclaimed); rayon; nylon; dacron; cotton; carbon black; zinc stearate; zinc oxide; sulfur; soap stone; xylene; and toluene. Water is obtained from the City and County of Denver and three company wells. The Denver plant operates continuously for 5.5 days a week. Approximately 5,800 people are employed.

As a result of previous studies conducted in 1964[1/] it was recommended that all wastewaters from the Gates complex be discharged into the municipal sewer by January 1, 1967. This disposal method has not been accomplished.

Gates water pollution control practices were evaluated by personnel from the National Field Investigations Center-Denver (NFIC-D), August 17 to 20, 1971. T. A. Conti of the Gates Environmental Control Section provided information and assistance.

B. WASTE SOURCES AND TREATMENT

Two categories of wastes are produced: a) those from manufacturing processes and b) those from rubber reclaiming. Six oil sumps collect process wastes. All sumps, except sump No. 3, discharge, without treatment, to the South Platte River through two outfall lines located at

South Cherokee Street (RM 322.35) and at Mississippi Avenue (RM 322.50).

Sump No. 3 collects all oily wastewater from the manufacturing processes. This wastewater then flows through an oil skimmer to a city-owned settling pond. Overflow from the pond discharges to the South Platte River (RM 322.25).

Wastewater (34,000 gpd) from the rubber reclaiming operation passes through a 60-mesh screen and is then discharged to the Denver municipal sewer.

C. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

From August 17 to 20, 1971, three 24-hr composite waste samples of the discharges from the Mississippi Avenue storm sewer and from the settling pond were collected. The composites were made up of four equal-volume grab samples. Temperature, pH, and conductivity were measured at the times samples were collected. Company officials estimated the flows [Table 1].

At the time of the survey the discharge from the Mississippi Avenue storm sewer contained a high concentration of oil and grease (19 mg/l). The effluent from the settling pond contained a concentration of suspended solids as high as 54 mg/l [Table 1].

D. SUMMARY AND CONCLUSIONS

1. In order to remove oil and grease the discharge from the Mississippi Avenue storm sewer requires treatment.

2. The effluent from the city-owned settling pond requires additional treatment in order to reduce the suspended solids concentration.

TABLE 1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
GATES RUBBER COMPANY
AUGUST 17-20, 1971

Parameter	Mississippi Avenue Outfall		Settling Pond Outfall	
	Average	Range	Average	Range
Flow (mgd)[a/]	0.65		1.02	
pH	7.6	7.0-8.0	8.6	7.0-9.0
Temperature (°C)		27-30		22-27
Cond. (µmhos/cm)		725-850		440-550
Oil & Grease (mg/l)	19	14-23	6	4-9
TS (mg/l)	500	430-550	350	330-370
SS (mg/l)	28	18-42	32	20-54

a/ Flows were estimated by Company officials.

3. Previous studies, by the South Platte River Basin Project in 1964, indicated that all waste discharges from this company could be diverted to the municipal sewer. However, this method of disposal has not been accomplished.

E. RECOMMENDATIONS

It is recommended that the Gates Rubber Company take the following pollution control measures:

1. Divert all wastewaters after treatment (i.e., oil & grease removal) to the municipal sewer by December 31, 1972, or

2. If the Company does not connect to the municipal sewer, the Gates Rubber Company wastewater discharges meet the following conditions:

a) oil and grease concentration shall not exceed 5 mg/l or 70 lb per day, whichever is less, and

b) suspended solids concentration shall not exceed 30 mg/l or 410 lb per day, whichever is less.

F. REFERENCE

1/ *A Study of Industrial Waste Pollution in the South Platte River Basin*, PR-6B, U. S. Department of the Interior, Federal Water Pollution Control Administration, South Platte River Basin Project. Denver, Colorado. December 1966.

GREAT WESTERN SUGAR COMPANY
BRIGHTON, COLORADO

A. GENERAL

The Brighton mill is a straight-house sugar beet refinery operation. It is rated at 2,178 tons per day of sliced beets, but averaged 2,100 tons per day during the 1971-72 campaign. This campaign started October 6, 1971, and ended in late January. The mill employs about 290 people during the campaign, 60 to 100 people during the interim, and from 15 to 50 persons who are engaged in sugar packaging throughout most of the year.

It was reported[1/] that in January 1965 this mill was discharging an effluent containing approximately 27,000 lb of BOD per day to the South Platte River. In order to achieve a water-quality improvement in the river the Project[1/] recommended that this plant reduce the waste load to a maximum BOD and suspended solids of 1,100 lb each per day. In October 1967 a new waste treatment system was installed to provide for the recirculation, treatment, and complete re-use of waste flume water. This improvement in waste treatment resulted in a 90-percent reduction in waste loads.[2/]

A water pollution survey performed (November-December 1969) by the Colorado Water Pollution Control Commission revealed that the Brighton mill violated the State water quality standards (for inadequate treatment).[3/] Overflow from flume and washwater settling ponds was not being pumped to the impounding lagoon, but allowed to drain into the McCann Ditch and subsequently discharged into the South Platte River.

Water pollution control practices at the plant were evaluated by the National Field Investigations Center-Denver (NFIC-Denver) personnel during December 1971. Great Western personnel contacted were: Gary Maggie, assistant district factory engineer, and Gus Schneider, master mechanic, Brighton.

B. WATER SUPPLY AND USES

The plant employs less than half the average water usage (2.75 mgd) for a sugar-beet processing plant of comparable size. Approximately 1.9 mgd is pumped from the McCann Ditch; 0.85 mgd from Company wells; and 0.01 mgd from the City of Brighton. The McCann Ditch pump station is located on a small pond that diverts McCann Ditch waters and receives condenser spray overflow. Discharge to the South Platte River is from this pond.

C. WASTE SOURCES AND TREATMENT

The only surface discharge from this mill consists of a condenser-spray pond overflow and excess water from McCann Ditch [Figure 1]. Company officials estimated the condenser overflow at 600 to 800 gpm -- plus an unknown amount of McCann Ditch flow. During the survey this discharge was measured at 3.6 cfs (1,600 gpm). Plant sanitary wastes are discharged to the Brighton municipal waste treatment plant.

The Brighton mill recycles all flume water. The flume water, after use in the plant, is pumped to a screen station (two 4-ft by 8-ft link-belt vibrating screens) and then discharged to a horseshore-shaped, earthen settling basin [Figure 1]. After passing through this primary basin the flume water enters the first of two secondary settling basins, each 125 ft by 210 ft. Effluent from the second of these basins is then diverted for

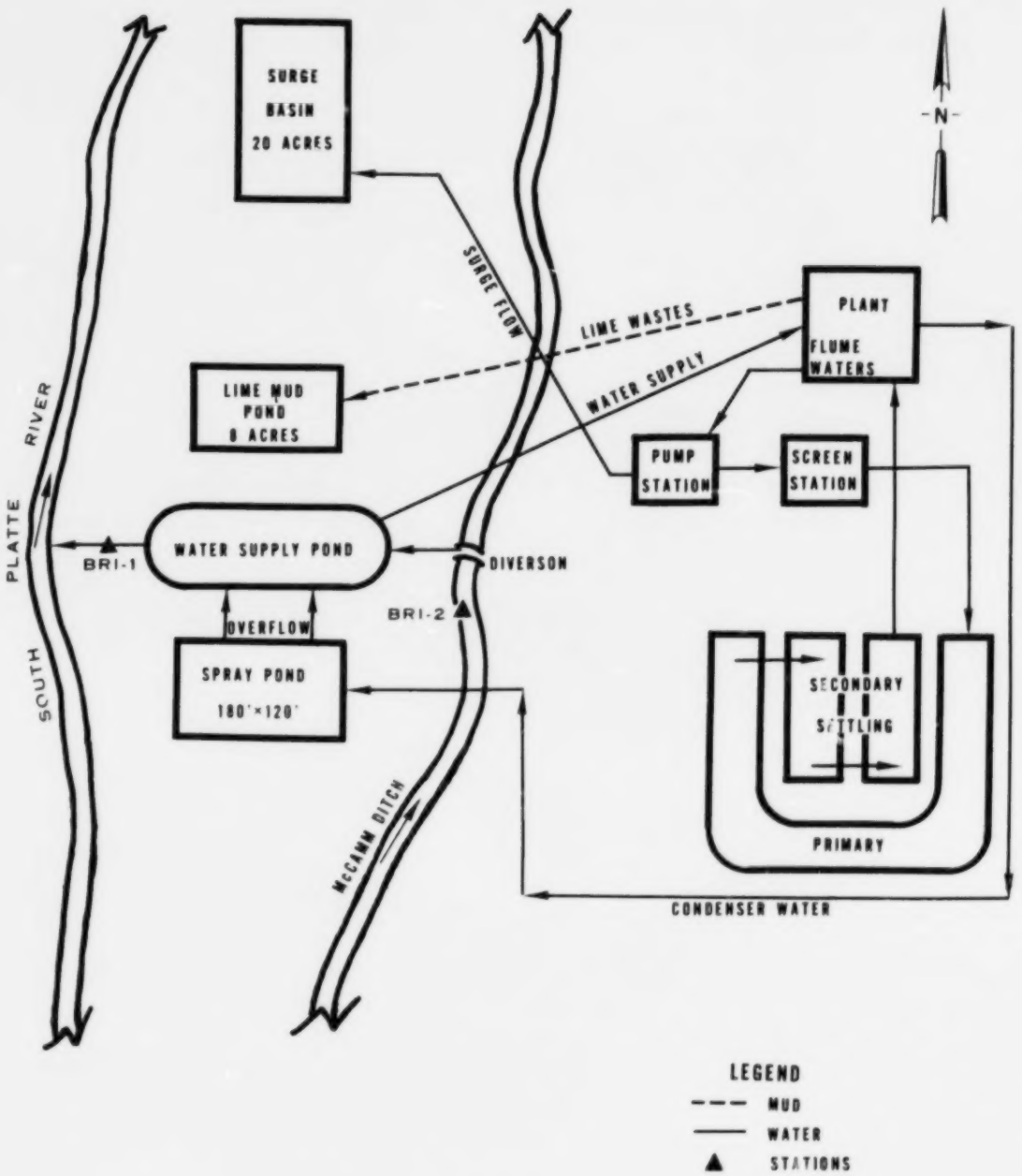

Figure 1. Plant Schematic and Sampling Stations Great Western Sugar Company Brighton, Colorado

various purposes such as the beet washer, wet hopper, and the constant level supply tank. A flow rate of approximately 5,000 gpm is maintained through the closed flume water circuit. Effluent from the secondary settling basins has a BOD of approximately 3,000 mg/l. The pH level is maintained at about 8.0 at all times by the addition of two-to-three tons lime. Muds are removed from the settling ponds periodically, placed on the periphery for drying, and then leveled out in the summer.

Lime mud wastes are passed through a pump into a six-to-eight acre pond located adjacent to the South Platte River. The pond is built about 30-to-40 feet above the surrounding terrain. No surface discharges occur from this pond; however, in the event of a dike failure, massive amounts of lime mud could spill into the river.

A surge pond (approximately 20 acres) receives excess flume water from the recycle ponds; bypassed flume water in case of pump failure or similar emergency; and, if necessary, other plant wastes.* No discharge was observed from the surge pond; however, historically, there have been incidents of overflows from the surge and lime ponds to McCann Ditch as a result of pump failures.

Waste loads attainable by the best practicable treatment technology currently available for the sugar beet industry and the present plant capacity are as follows:

a) BOD - shall not exceed 0.2 lb/ton of beets sliced or 430 lb/day; whichever is less;

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* At this mill most of the general plant wastes, i.e., floor drains, boilouts, spills, scrubber washer effluent are discharged into the flume water circuit. Press washwaters and some condensates also enter the flume system.

b) Suspended solids - shall not exceed 0.5 lb/ton of beets sliced or 1,075 lb per day, whichever is less; and

c) Fecal coliform bacteria - if pathogenic organisms are demonstrated to be present in the discharge, the effluent shall be regulated so that fecal coliform bacteria shall not exceed 1000/100 ml.

D. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

In-plant sampling was conducted at this mill December 6 through 11, 1971. Three 24-hr composite samples were collected of the McCann Ditch flow and the plant effluent for chemical analyses [Table 1]. Field measurements (pH, temperature, and conductivity) were made several times each day. Five daily grab samples of the mill effluent and the major raw water source, McCann Ditch, were collected for bacteriological determinations. No significant variations in water quality were observed between the McCann Ditch water source and treated mill effluent, except for a 3-fold rise in water temperature [Tables 1 and 2].

The Brighton mill was discharging an average of 230 lb BOD per day (0.11 lb per ton of beets sliced) during the survey. There was no significant difference between the BOD of the raw water supply (McCann Ditch) and that of the plant effluent. Company data for the 1971-72 campaign indicate that the final effluent contained an average of 0.07 lb BOD per ton of beets sliced.

Nutrients in the mill effluent were adequate* to stimulate massive growths of algae and slimes in the South Platte River downstream. Company officials attribute these high values to the poor quality of McCann Ditch

* Data reported by the Company for the period October through December 1971 indicate the effluent contained phosphorus in the range of 0.05 to 0.25 mg/l and the inorganic nitrogen in the range of 15.7 to 17.7 mg/l.

TABLE 1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
DECEMBER 6-10, 1971

Sta. No.	Station Description		Flow cfs	Temp. (°C)	Cond. (µmhos)	BOD (mg/l)	Alkalinity (mg/l)
BRI-2	McCann Ditch at intake	Range	4.4	0.0-5.0	400-1.400	3-35	253-288
		Average	4.4			14	273
BRI-1	Plant effluent	Range	3.3-4.3	7.0-15.0	850-1,400	6-20	253-288
		Average	3.6			12	273

TABLE 2

SUMMARY OF BACTERIOLOGICAL RESULTS
DECEMBER 6-10, 1971

Sta. No.	Station Description	Fecal Coliform (MF Count/100 ml)			Fecal Streptococci (MF Count/100 ml)		
		Maximum	Log Mean	Minimum	Maximum	Log Mean	Minimum
BRI-2	McCann Ditch at intake	>6,000	>330	140	5,400	810	100
BRI-1	Plant effluent	>6,000	>110	20	8,700	1,700	500

water. During October through December 1971 total phosphorus and inorganic nitrogen in the water supply ranged from 0.07 to 0.16 mg/l and 11.2 to 14.3 mg/l, respectively.

E. SUMMARY AND CONCLUSION

1. Water pollution control practices at the Brighton mill have improved significantly since 1965 studies. However, nutrients in the effluent were high, but Company officials attribute this to the poor quality of the intake water from McCann Ditch.

2. The lime mud pond is located adjacent to the South Platte River and, in case of dike failure, represents a potential pollution hazard.

3. This mill discharged 550 gallons of wastewater per ton of beets sliced, a low figure when compared to other mills of similar size.

F. RECOMMENDATIONS

It is recommended that:

1. The waste discharge limit attainable by "best treatment" be included in the conditions for the Corps of Engineers Refuse Act Permit to be issued to the Great Western Brighton mill.

2. The lime mud pond and the surge pond be sealed to prevent excessive percolation, and the dikes of all ponds be constructed in accord with best engineering practices to preclude possible dike failure.

3. The Company be commended for water conservation and the significant improvements in waste treatment attained since the 1966 Conference.

G. REFERENCES

1. *Report to the Second Session of the Conference in the Matter of Pollution of the South Platte River Basin*, U. S. Department of Health, Education, and Welfare, Federal Water Pollution Control Administration, South Platte River Basin Project, April 27, 1966.

2. *The Beet Sugar Industry -- The Water Pollution Problem and Status of Waste Abatement and Treatment*, PR-8, U. S. Department of the Interior, Federal Water Pollution Control Administration, South Platte River Basin Project, Denver, Colorado, June 1967.

3. *Water Pollution Survey of the Great Western Sugar Company and the Kuner-Empson Canning Company of Colorado*, Colorado Water Pollution Control Commission, November 24, 1969 to March 11, 1970.

GREAT WESTERN SUGAR COMPANY
EATON MILL
EATON, COLORADO

A. GENERAL

The plant at Eaton is a straight-house sugar refinery; end molasses is shipped to the Loveland and Longmont Great Western facilities. The 1971-72 campaign started October 4, 1971, and terminated on January 16, 1972. At the time of the visit, the plant was processing an average of 2,322 tons of beets per day. The plant has 130 employees during the campaign and retains some 40 persons full time during the remainder of the year.

During the 1965-66 campaign only 20 to 25 percent of the flume water was recirculated. The main plant sewer was an open discharge to Eaton Draw. It contained all plant wastes except lime mud, pulp silo drainage, and sanitary sewage. The only waste treatment provided was the separate handling and storage of lime mud that went to a pond with no apparent overflow.[1/]

The water pollution control practices at this mill were evaluated by personnel of the National Field Investigations Center-Denver from November 26 to December 3, 1971. Great Western officials contacted were Don Morris, plant superintendent; Lynn Hullinger, chief chemist; Ron Olson, master mechanic; and Gary Maggie, assistant district factory engineer for the Great Western Sugar Company.

B. WATER SUPPLY AND USES

The Eaton mill receives all of its water supply (3 mgd) from Company-owned wells. However, during water-short periods water is withdrawn from

the Eaton Draw via the ditch which normally carries the excess spray pond water.

The beets are transported into the plant via a flume system. Water in the system is maintained at a pH of 7.5. This water is then screened and either re-cycled directly or sent to the treatment system and then re-cycled to the plant. Acidic and caustic boilouts enter this system.

Water is first employed to extract the sugar and is then evaporated and condensed. Condensates are re-used as boiler supply, or as centrifuged washwater, or discharged to the spray pond. A minimum of 3,500 gpm is required to run the various condensers.

Pulp press waters are re-used in the diffuser or employed in preliming. Factory floor drain wastes are collected into a sump and re-used in juice recovery.

C. WASTE SOURCES AND TREATMENT

Three surface discharges from the Eaton mill were evaluated. These are described as follows:

1. The excess condenser water from the spray pond [Figure 1] accounts for more than 90 percent of the total plant discharge volume. According to Company data, the BOD of this effluent varied from 3 to 15 mg/l during the 1971-72 Campaign.

2. Gas scrubber effluent from the kiln house is released separately to Eaton Draw (average flow about 50 gpm). Company data show that the effluent BOD varied from 6 to 51 mg/l.

3. Boiler blowdown is also discharged directly to Eaton Draw. Accordding to Company data flows ranged from 40 to 204 gpm. The BOD ranged from 20 to 138 mg/l.

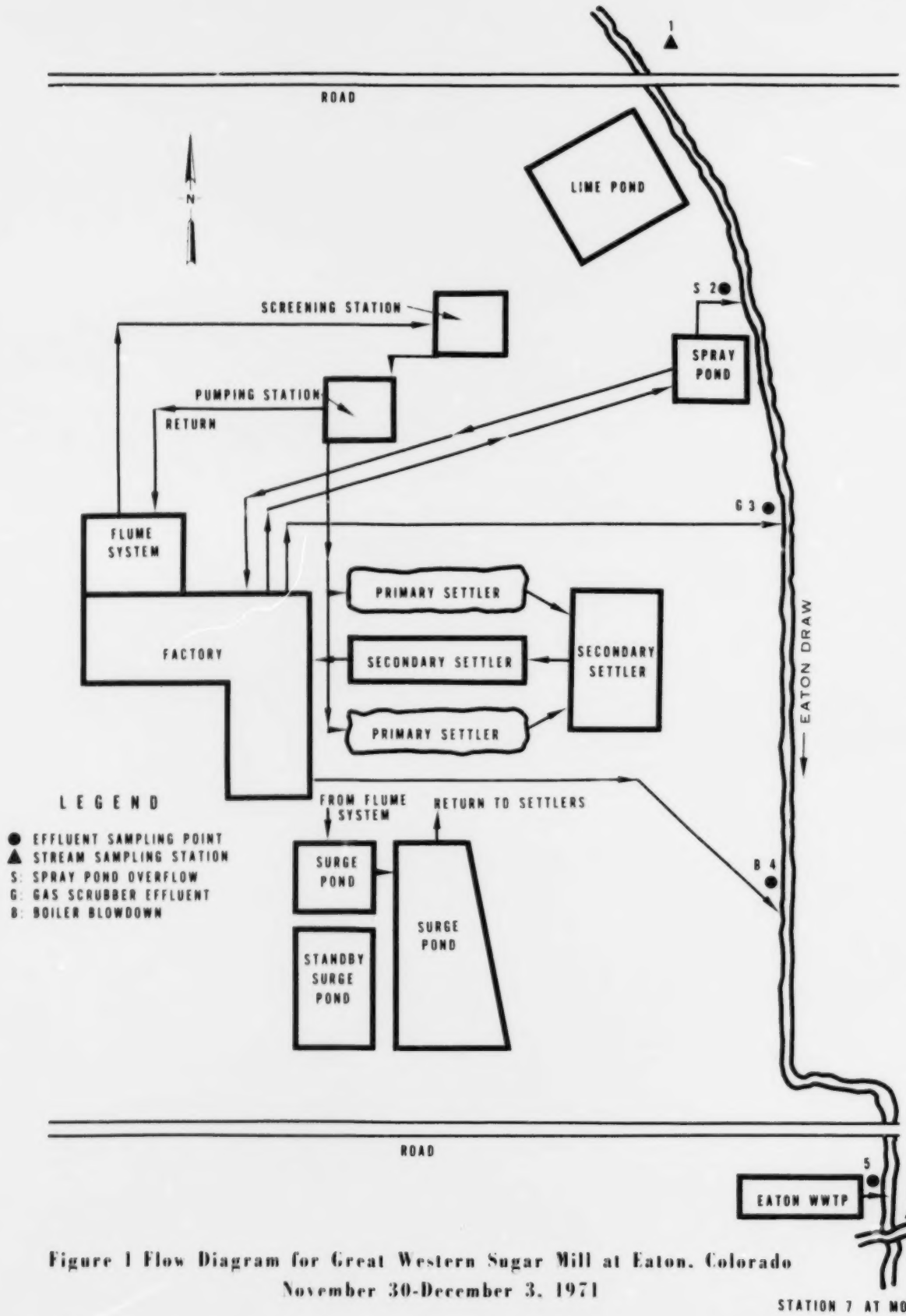

Figure 1 Flow Diagram for Great Western Sugar Mill at Eaton, Colorado November 30-December 3, 1971

The Eaton mill has a closed flume-water, recycle system. After use in the beet washing operation, flume-water is passed over three Link-Belt vibrating screens (4 ft by 8 ft). During a tour of the plant on November 26, 1971, only two of these screens were observed operating. A portion of the flow can be recycled from the screen to the head of the beet flume. Residual flume waters, 3,000 to 3,500 gpm, are discharged to the treatment works, consisting of two oval-shaped earthen primary basins operating in parallel (each approximately 400 ft by 60 ft by 10 ft) and two secondary basins in series (300 ft by 100 ft and 250 ft by 100 ft, respectively -- both about 10 ft deep). The system is maintained at a pH of about 7.5 by the addition of five-to-six tons of lime daily.

Overflow from the secondary basins is returned to the factory. Flume muds from the primary and secondary basins are deposited in a low area on the south edge of the factory property.

Three surge ponds are located south of the settling basins to receive excess flow from the flume circuits. The first pond [Figure 1] is about 100 ft by 200 ft and, during the survey, was about one-half filled. Flow from the first pond discharges to a trapezoidal pond (450 ft by 350 ft by 530 ft by 175 ft). This, the second pond, was nearly full. Overflow from the second pond is returned to the settling basins. The third surge pond which is 200 ft by 330 ft had not been used at the time of the survey. Overflow from this pond is presumably returned to the primary settling basins and then to the factory; however, plant officials were not absolutely certain of the flow pattern.

Lime muds are discharged to a large lagoon (approximately 10 acres and non-overflowing), located northeast of the factory along Eaton Draw. No direct seepage was visible but percolation probably enters Eaton Draw.

The treatment facilities were reported by Company officials to cost $250,000. Dike construction around the settling basins was poor; numerous cracks were observed in the earthen walls. Further stabilization of the dikes is necessary to preclude failures and excessive seepage.

Sanitary sewage from this mill goes to the Eaton municipal sewer.

Waste loads have been proposed for this plant under the Refuse Act Permit Program on "best treatment" for the sugar beet industry and present plant capacity. These loads are as follows:

a) BOD - not to exceed 0.3 lb/ton of beets sliced or 700 lb per day, whichever is less;

b) suspended solids - same as for BOD; and

c) Fecal coliform bacteria - if pathogenic organisms are demonstrated to be present in the discharge, the effluent shall be regulated so that fecal coliform bacteria shall not exceed 1000/100 ml.

D. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

Three discharges from the mill [Figure 1] were sampled: the spray pond effluent (RM 7.0), the gas scrubber effluent (RM 6.9), and the boiler blowdown (RM 6.85). The effluent from the Eaton Wastewater Treatment Plant (WTP) was also sampled (RM 6.6). In addition, three stations on Eaton Draw were sampled: Eaton Draw upstream of Great Western outfalls (RM 7.2), Eaton Draw downstream from the Eaton WTP effluent (RM 6.5), and Eaton Draw at the mouth (RM 0.1).

One grab sample per day (November 30, 1971 to December 4, 1971) was taken at the Eaton Draw stations. Field measurements of temperature, pH, and conductivity were made at the time of the sampling. A SERCO automatic sampler was used to obtain a 24-hr composite on the spray pond effluent. Grab samples of the gas scrubber effluent were composited every four hours. The boiler blowdown discharge was sampled for field measurements only.

Eaton Draw upstream of the Great Western Sugar Company discharge had a BOD of 3.4 mg/l. The spray pond and gas scrubber discharges from the Great Western Sugar Company had BOD levels of 21 and 15 mg/l, respectively [Table 1].

The Eaton Wastewater Treatment Plant effluent had a BOD level of 72 mg/l. Although this is high, the load discharged was only about 100 lb per day. In 1965 the Eaton treatment plant consisted of a primary septic tank and sand filters that were in poor condition. (About one-third of the influent was being bypassed to Eaton Draw and the remainder received minimum treatment.)

The present plant consists of an oxidation ditch with brush aeration, a secondary clarifier, and chlorination before discharge to Eaton Draw. However, there has been only a slight improvement in effluent quality since 1965 (72 mg/l versus 94 mg/l).

The log mean fecal-coliform and fecal-streptococci bacteria densities* in the Great Western mill discharges were lower than those at the background stations (RM 7.2) where a fecal coliform count of greater than

* Bacteria densities are log mean concentrations, unless otherwise specified.

TABLE 1
FIELD MEASUREMENTS AND ANALYTICAL RESULTS
NOVEMBER 30-DECEMBER 3, 1971

Map Key	Station Description		Flow	Temp. °C	Cond. µmhos/cm	pH	BOD mg/l	TOC mg/l	DO mg/l
1	Eaton Draw upstream of Great Western Co. discharge (RM 249.0/6.9/7.2)	Range	1.7-2.1	2.0-7.0	1,400-1,520	8.0-8.3	2.0-6.6	5-10	8.3-10.5
		Average	1.8				3.4	8	
2	Spray pond discharge Great Western Co. (RM 249.0/6.9/7.0)	Range	4.2-4.3	24.0-25.0	1,400-1,500	7.7-8.1	13-25	6-15	
		Average	4.3				21	10	
3	Gas scrubber discharge Great Western Co. (RM 249.0/6.9/6.9)	Range	0.02-0.03	13.0-23.0	1,350-2,000	7.5-10.5	10-24	10-140	
		Average	0.03				15	54	
4	Boiler blowdown Great Western Co. (RM 249.0/6.9/6.8)	Range		48.0-55.0	400-570	8.2-9.2			
		Average							
5	Discharge from Eaton WTP (RM 249.0/6.9/6.6)	Range	0.22-0.27	0.0-10.0	1,650-2,100	7.4-7.8	46-100	17-130	
		Average	0.25				72	65	
6	Eaton Draw downstream from Eaton WTP (RM 249.0/6.4/6.5)	Range		15.0-19.0	1,450-3,000	7.8-8.2	12-36	7-19	3.0-4.0
		Average					26	13	
7	Eaton Draw at mouth (RM 249.0/6.9/0.1)	Range	21.8-23.1	4.0-8.5	1,500-1,850	7.8-8.3	12-18	9-11	9.1-10.0
		Average	22.4				14	10	

920 and a fecal streptococci count of 16,000 [Table 2] were measured. The discharge from the Eaton treatment plant had a fecal coliform count of 12,000/100 ml. Downstream from the treatment plant, the fecal coliform count in Eaton Draw increased to 1,700/100 ml and the fecal streptococci increased to 47,000/100 ml.

In 1965, the Eaton Great Western mill discharged 20,800 lb per day of BOD (9 lb per ton) and 15,200 lb suspended solids per day (5 lb per ton) and increased the fecal-coliform bacteria density in Eaton Draw by 300,000 MPN/100 ml greater than the densities observed upstream. The recommendations of the 1966 Conference on the Matter of Pollution in the South Platte River Basin stated that the BOD and suspended solids loading from the Eaton factory should not exceed 1,000 lb per day and that the density of fecal-coliform bacteria in the receiving stream not be increased by more than 1,000/100 ml. During the 1971 survey the Great Western Sugar Company was discharging 490 lb of BOD (0.2 lb per ton) and, as indicated earlier, the fecal coliform bacteria densities were much lower in the effluent than in the receiving stream. Company data [Table 3] for the 1971-72 campaign indicated that loads of BOD and suspended solids ranged from 0.13 to 0.34 lb per day and 0.40 to 1.1 lb per day, respectively.

E. SUMMARY AND CONCLUSIONS

The Great Western Sugar Company has markedly improved the treatment at its Eaton mill since the 1965 survey. The SS loads discharged during the 1971-72 campaign exceeded the conditions set by the Refuse Act Permit Program for the plant. Additional solids removal is necessary to meet the 0.3 lb total suspended solids per ton of beets specified.

TABLE 2
RESULTS OF BACTERIOLOGICAL ANALYSES
NOVEMBER 30-DECEMBER, 1971

Map Key	Station Description	Fecal Coliform/100 ml			Fecal Streptococci/100 ml		
		Maximum	Log Mean	Minimum	Maximum	Log Mean	Minimum
1	Eaton Draw upstream of Great Western Co. (RM 249.0/6.9/7.2)	<6,000	<920	180	98,000	16,000	4,200
2	Spray pond overflow from Great Western Co. (RM 249.0/6.9/7.0)	120	21	4	19,000	7,900	5,200
3	Gas scrubber discharge from Great Western Co. (RM 249.0/6.9/7.0)	900	<47	<10	58,000	4,100	200
5	Eaton WTP effluent (RM 249.0/6.9/6.6)	<60,000	12,000	5,900			
6	Eaton Draw downstream from Eaton WTP (RM 249.0/6.9/6.5)	8,900	1,700	780	130,000	47,000	16,000
7	Eaton Draw at mouth (RM 249.0/6.9/0.1)	720	500	360	18,000	6,800	2,900

TABLE 3

ANALYTICAL DATA
SUBMITTED BY THE GREAT WESTERN SUGAR COMPANY
MILL AT EATON, COLORADO

Map Key	Station Description	Month	Flow mgd	Temp. °C	pH	BOD mg/l	BOD lbs/day	Total Solids mg/l	Suspended Solids mg/l	Suspended Solids lbs/day	Fecal Coliform Count/100 ml	Fecal Streptococci Count/100 ml
2	Spray pond discharge Great Western Sugar Company, Eaton, CO. (RM 249.0/6.9/7.0)	October 1971	2.68	20-28	8.1	15	335	1,561	91	1,850	140	750
		November 1971	3.09	16-26	8.0-8.3	3	78	1,294	74	1,910	<10	165
		December 1971	2.11	23-27	7.9-8.2	3	53	1,352	140	2,460	10	450
		January 1972	2.46	23	8.2	3	62	1,192	28	575	20	
3	Gas scrubber discharge Great Western Sugar Company, Eaton, Colorado (RM 249.0/6.9/6.9)	October 1971	0.068	22-24	7.8-8.0	6	3.4	1,948	219	124	23,000	111,000
		November 1971	0.039	20-30	7.6-8.0	11	3.5	2,731	1,344	436	25	590
		December 1971	0.065	17-25	7.4-8.1	4	2.2	2,238	266	144	160	60
		January 1972	0.017	19	7.2-7.8	739	104	1,564	244	352	10	

Construction of dikes around settling basins was poor. Numerous cracks have occurred in the dikes. As a result, there are increases in the amount of seepage from these basins. Additional stabilization of the dikes is necessary in order to reduce seepage and preclude the possibility of dike failure.

F. RECOMMENDATIONS

It is recommended that:

1. The waste load limits proposed for the Refuse Act Permit be met (i.e., BOD and suspended solids shall not exceed 0.3 lb each per ton of beets processed or 700 lb per day, whichever is less, and, if pathogenic organisms are demonstrated to be present in the discharge, the effluent shall be regulated so that fecal coliform bacteria shall not exceed 1,000/100 ml.

2. All wastewater ponds be constructed in accordance with best engineering practices in order to prevent excessive seepage and to preclude possible dike failures.

G. REFERENCES

1. *The Beet Sugar Industry -- The Water Pollution Problem and Status of Waste Abatement and Treatment*, PR-8, U. S. Department of Interior, Federal Water Pollution Control Administration, South Platte River Basin Project. Denver, Colorado. June 1967.

GREAT WESTERN SUGAR COMPANY
FORT MORGAN MILL
FORT MORGAN, COLORADO

A. GENERAL

The Fort Morgan sugar-beet processing mill is a Steffen-house operation. During the 1971-72 campaign (September 28-February 4) an average of 3,570 tons of beets per day were processed. Employment during the campaign was 260. Fifty-five people are employed in routine construction and maintenance and in the production and sale of high grade lime during the remainder of the year. The mill has a rated capacity of 3,450 tons per day of sugar beets and also processes 170 tons per day of molasses.

In December 1963 this mill discharged more than 22,000 pounds of BOD to the South Platte River.[1/] Company officials reported that more than one-half million dollars has been spent since 1969 in water pollution control improvements and internal plant changes. The Colorado Implementation Plan originally established a compliance date of December 31, 1969, for installation of "revised waste handling procedures". This date was later extended to December 31, 1971, a date beyond that recommended by the Conferees to the South Platte River Basin Enforcement Conference (i.e., June 30, 1971).

Water pollution control practices at this mill were evaluated by personnel of the National Field Investigations Center - Denver (NFIC-Denver) during November 29 to December 3, 1971. Company personnel providing information and assistance were: Robert Troudt, plant superintendent; James Young, master mechanic; Ray Kaiser, district engineer; and Jack Powell, district manager.

B. WATER SUPPLY AND USES

The average water supply is 11.4 mgd of which 11.1 mgd is obtained from a lake located on plant property; the remainder is purchased from the City of Fort Morgan. (The lake is fed by a major irrigation canal originating on the South Platte River about 12 miles upstream of Fort Morgan.) City water is used for emergency boiler feed, sanitary needs, turbine packing, and the CSF filters.

C. WASTE SOURCES AND TREATMENT

Condenser water, the major source of wastewater from this mill, averaged 11.9 mgd during the survey. The Refuse Act Permit application cites only 10.0 mgd from this source. The reason for this discrepancy was not determined.

The Fort Morgan mill has recently completed the final year of a 3-yr program for constructio and installation of a full-system waste treatment facility. [All the pollution control facilities completed are illustrated in Figure 1.]

The flume-water recycle rate is about 8500 gpm. Water in the closed circuit is maintained at a pH between 8.0 and 12.0 by the daily addition of five-to-seven tons of lime. All flume water is pumped across three, link-belt travelling screens (5 ft by 8 ft). Screened flume water (approximately 3000 gpm) is returned to a constant level tank for re-use; the remainder (5000 to 6000 gpm) is conveyed to a 90 ft diameter EIMCO clarifier for settling mud. Normally overflow from the clarifier is returned to the constant-level tank as flume water supply. However, the overflow can be by-passed and pumped to a surge pond (450 ft by 150 ft by 11 ft), as was the case during the plant evaluation.

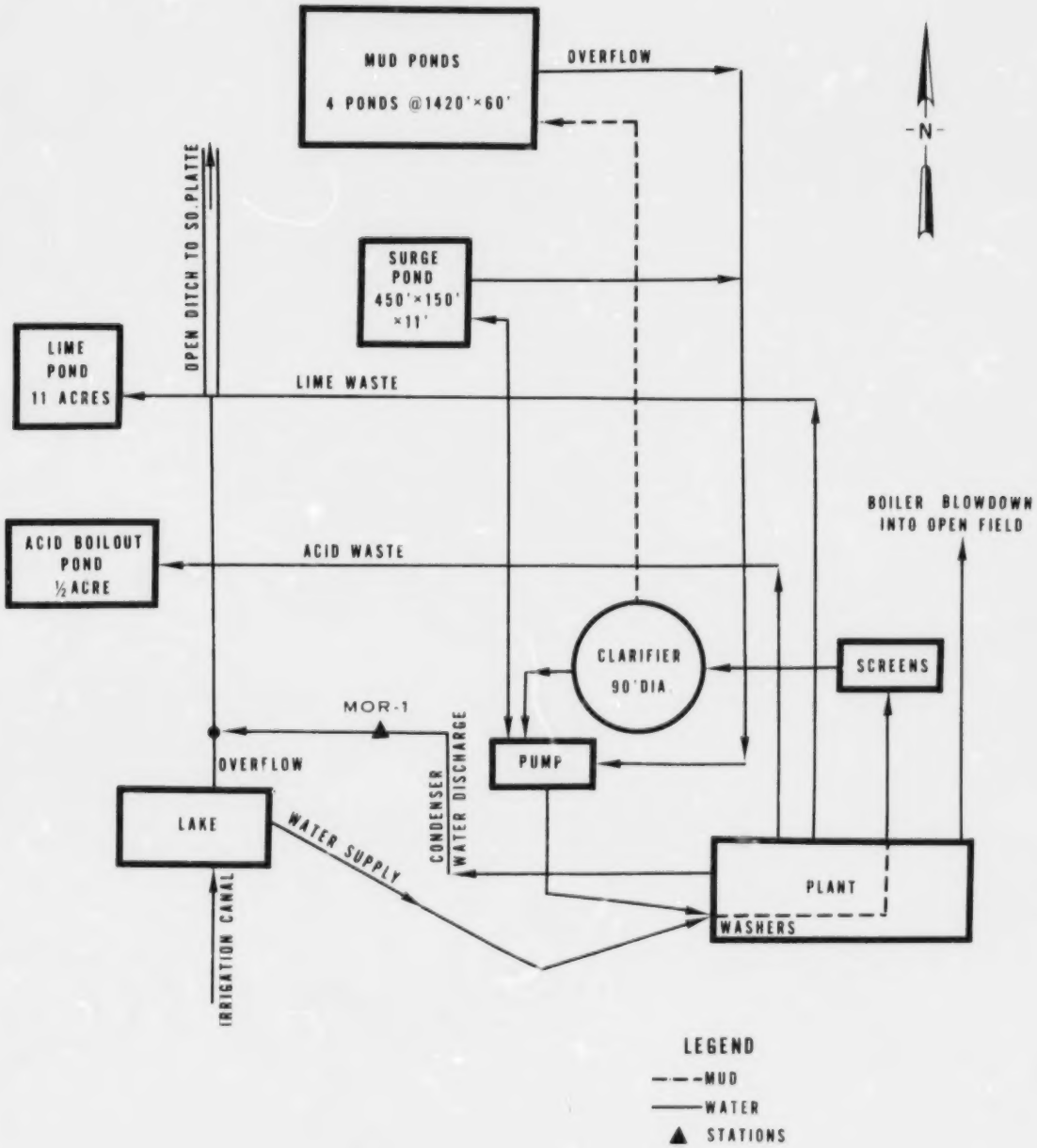

Figure 1.Plant Schematic and Sampling Stations Great Wertern Sugar Company Fort Morgan.Colorado

Settled muds from the clarifier are pumped across the highway to four mud ponds (each 1,420 ft by 60 ft by 5 to 8 ft), with one pond being used at a given time. The muds are allowed to settle and the supernatant is returned to the primary beet flume. When the mud pond is filled, flow is transferred to an alternate pond. Periodically the muds are cleaned out by dragline and hauled away. Lime muds from the straight- and Steffen-house operations and some wastage from the CSF operation are conveyed to an 11-acre lime mud pond.

The mud ponds cover an area that was the site of the original lime mud ponds. The stability of the lower mud ponds and the present lime mud ponds were judged, by EPA investigators, to be poor. A dike failure would discharge these wastes into adjacent marshy lowlands and, subsequently, into the South Platte River.

Acid and caustic boilouts are conveyed to a deep, unlined (non-over-flowing pit) about one-half acre in area. Boiler blowdown is discharged into an open field. The mill has installed curbings around many of the unit operations in order to prevent spills and leakage from reaching the floor drains. Most of the wastes washed into the floor drains are either collected in the constant-level tank or enter the closed-flume water circuit. However, there is a possibility that these enter the condensate drain, which subsequently merges with the lake overflow, and then discharge to the South Platte River.

Waste loads have been proposed for this plant under the Refuse Act Permit Program based on "best treatment" for the sugar beet industry and on present

plant capacity. These loads are as follows:

1. BOD - not to exceed 0.5 lb/ton of beets sliced or 1,820 lb per day, whichever is less;

2. Suspended solids - same as BOD;

3. Fecal coliform bacteria - if pathogenic organisms are demonstrated to be present in the discharge, the effluent shall be regulated so that fecal coliform bacteria shall not exceed 1000/100 ml.

D. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

Effluent sampling [Station MOR-1, Figure 1] was conducted during November 29 to December 3, 1971. Three 24-hr composite samples were collected for chemical analyses using Serco samplers. Field measurements of pH, conductivity, and temperature were made periodically; a grab sample was collected daily for bacteriological analyses. Results of the analyses [Tables 1 and 2] indicate that about 2,300 lb per day (0.65 lb/ton) of BOD was discharged. Company data collected during the 1971-72 campaign showed that the BOD ranged from 26 mg/l (0.48 lb/ton) to 279 mg/l (7.35 lb/ton). Plant officials are investigating the possible sources of this high BOD, e.g., floor drain and sewer connections to the condensate water sewer.

The South Platte River upstream of the mill discharge was relatively clean, as indicated by the presence of mayflies and caddisflies. Downstream, slimes and algae were nurtured* by the discharge from the mill. The benthos was affected adversely in this reach, numbering 257/sq ft of which 83 percent were sludgeworms.

* Company data indicate that, during the 1971-72 campaign, the effluent contained an average of 7.56 mg/l inorganic nitrogen and 0.06 mg/l phosphorus.

TABLE 1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
GREAT WESTERN SUGAR COMPANY
FORT MORGAN MILL
NOVEMBER 29-DECEMBER 3, 1971

Station	Description		Flow mgd	Temp. °C	Cond. µmhos/cm	pH	BOD mg/l	Alkalinity (as $CaCO_3$) mg/l
MOR-1	Condenser water	Average	11.9					275
		Range	10.4-14.4	28-32	1,250-2,150	8.2-8.6	12-34	270-280

TABLE 2

SUMMARY OF BACTERIOLOGICAL RESULTS

		Fecal Coliforms/100 ml				Fecal Streptococci/100 ml		
Station	Description	Maximum	Log Mean	Minimum	% Samples <2000	Maximum	Log Mean	Minimum
MOR-1	Condenser water	48	<10	<4	0	13,000	1,900	180

E. SUMMARY AND CONCLUSIONS

The data collected during the effluent sampling indicate that there has been a substantial reduction in the waste loads discharged by this plant since 1963. However, the Company data show there were discharges of effluent, during the 1971-72 campaign, that exceeded 26,000 lb BOD per day (7.4 lb/ton). The possible causes of the high BOD in the condenser water were being investigated by Company officials.

Effects of the waste discharge on the South Platte River were evident by the slime and algae growths and the change in the benthic community.

Construction of dikes around the ponds is poor. This situation permits increases in the seepage rate from these ponds. Additional stabilization of the dikes is necessary in order to reduce the seepage and preclude the possibility of a dike failure.

F. RECOMMENDATIONS

It is recommended that:

1. Waste load limits proposed for the Refuse Act Permit be met (i.e., BOD and suspended solids discharged shall not exceed 0.5 lb each/ton of beets processed or 1,820 lb per day, whichever is less, and, if pathogenic organisms are demonstrated to be present in the discharge, the effluent shall be regulated so that fecal coliform bacteria shall not exceed 1000/100 ml).

2. All wastewater ponds be constructed in accordance with best engineering practices to prevent excessive seepage and to preclude possible dike failures.

G. REFERENCES

1/ *The Beet Sugar Industry -- The Water Pollution Problem and Status of Waste Abatement and Treatment*, PR-8 U.S. Department of Interior, Federal Water Pollution Control Administration, South Platte River Basin Project. Denver, Colorado. June 1967.

GREAT WESTERN SUGAR COMPANY
JOHNSTOWN SUGAR RECOVERY AND MONOSODIUM GLUTAMATE PLANT
JOHNSTOWN, COLORADO

A. GENERAL

The factory at Johnstown is comprised of a sugar recovery house and a monosodium glutamate (MSG) plant. About 163,600 lb of sucrose and 13,800 lb of MSG are produced per day. The factory operates year round, except for a few weeks' annual shut-down for maintenance, and employs approximately 405 people.

The sugar recovery plant receives molasses from five Steffen houses and uses, to extract sugar, the barium saccharate process. This process generally involves the regeneration of barium carbonate and the precipitation of sugar from molasses by barium hydrate.

The MSG establishment employs concentrated Johnstown filtrate and concentrated Steffen filtrate as the two primary raw materials.

In 1965,[1/] wastewater treatment consisted of segregating weak and strong wastes, the weak wastes going directly to the Little Thompson River and the strong wastes to a treatment lagoon, with constant overflow to the Little Thompson River.

The Colorado Water Pollution Control Commission set a compliance date of December 31, 1969 (later extended to October 1, 1970) by which time the plant would have the "indicated treatment" (not defined). (The Conferees to the South Platte River Basin Enforcement Conference recommended that all discharges into the South Platte River Basin shall have adequate remedial or control facilities by June 30, 1971.)

Water pollution control practices were evaluated by personnel of the National Field Investigations Center-Denver (NFIC-D) during December 1971.

Great Western officials contacted were Robert Monroe, general manager; Tony Flasco, district engineer; Jim Dalbey, assistant district engineer; T. Miller, factory manager, Johnstown; Richard Mann, plant chemist; and Richard Dayton, master mechanic.

B. WATER SUPPLY AND USES

Water (approx. 3.75 mgd) is obtained from Hillsboro canal; this amount is supplemented by direct take-off from the Little Thompson River. The plant also obtains water from wells (approx. 0.87 mgd) and from the City of Johnstown (0.45 mgd). Water is employed in cooling, evaporation, filter washing, gas scrubbing, clean-up, and for sanitary purposes.

C. WASTE SOURCES AND TREATMENT

Condenser water (approx. 600 gpm) is conveyed in a separate line to stabilization ponds [Figure 1]. Strong chemical spills, acid and caustic washings, and the lime kiln scrubber overflow go to a chemical pond that has no overflow. Prior to this evaluation, general plant wastes (approx. 2,200 gpm) were discharged to two aeration basins in parallel (each, 325 ft by 160 ft by 15 ft); each equipped with a 75-hp aerator. Overflow then went to the stabilization pond that covers 10-12 acres. However, since August 1971, the aeration basins were temporarily out of service for new construction that involved the removal of the common center wall between the two aeration basins, thus converting to a single unit (650 ft by 160 ft). A third 75-hp aerator was to be installed with construction scheduled for completion in January 1972. At the time of this evaluation general plant wastes flowed directly into the stabilization ponds.

Company officials stated that the "old" aeration basins and the

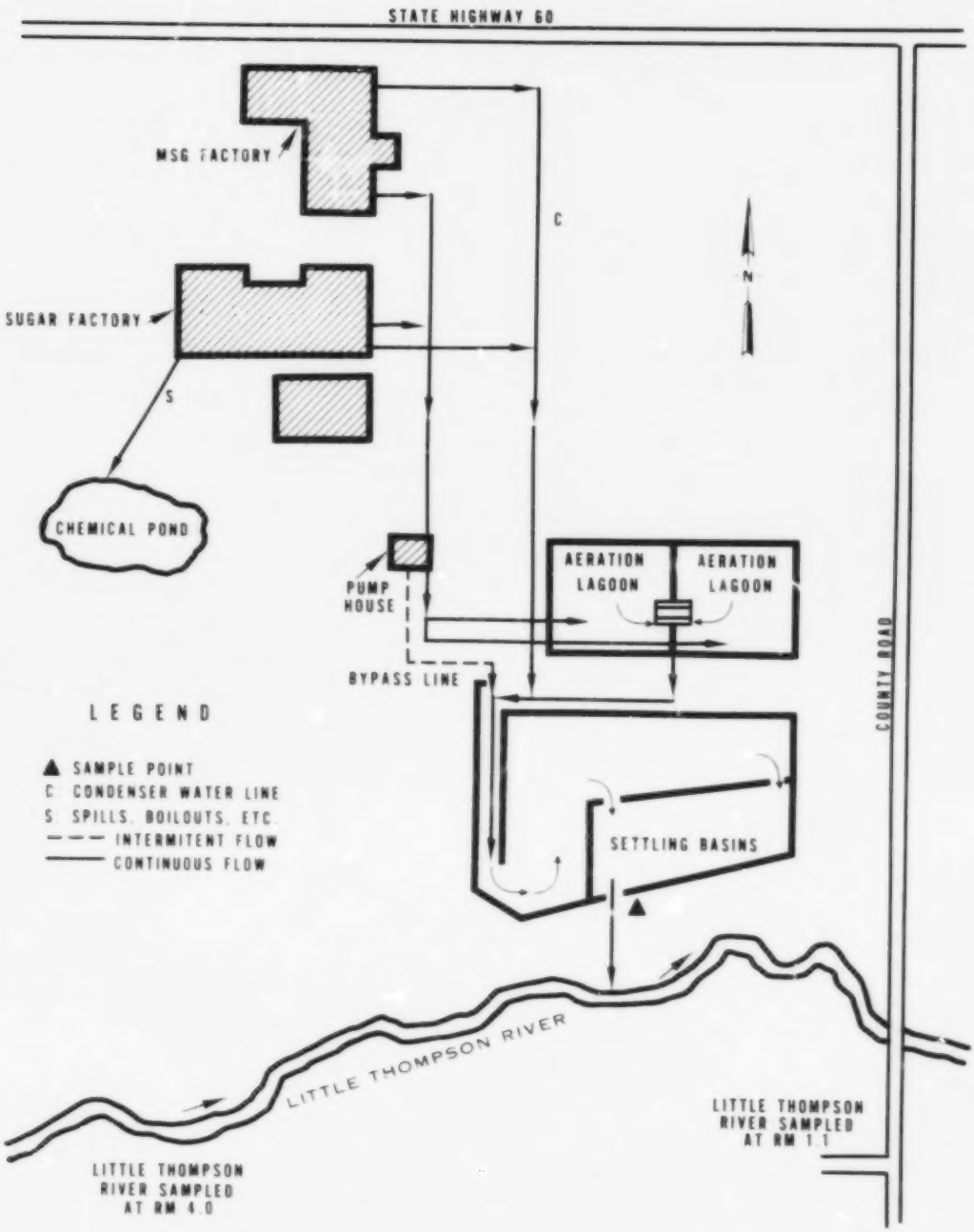

Figure 1 Flow Diagram of Great Western Sugar Co. at Johnstown, Colorado December 6-11, 1971

stabilization ponds provided approximately 60 percent BOD reduction. With the modification of the aeration basins, Company officials estimate the BOD removals will be about 80 percent. A stilling chamber (60 ft by 20 ft) was being installed in order to settle sludge from the aeration basin effluent. The sludge is to be returned to the basin with the effluent being discharged to the stabilization ponds. There was no plan to convey the return sludge to the top end of the basin; instead, the settled (activated) sludge will be allowed to "filter" from the stilling chamber into the aeration basins.

Wastes entering the stabilization pond system flow through three compartments in series. The pond overflow is discharged over a weir and into an open ditch to the Little Thompson River. Three 5-hp aerators, which were previously used in the chemical pond, had been removed and installed in the third compartment of the stabilization pond. The ponds are between two and four feet in depth, odorous, and almost completely anaerobic. Visual observations indicated that the pond effluent is extremely poor. The detention time in the stabilization ponds is estimated to be about five days.

The first compartment of the pond is cleaned once every two years; the remaining compartments have never been cleaned. No improvement in cleaning schedules has apparently been made since completion of the South Platte River Basin Project studies in 1965.[1/] The Company reports that wastes enter the stabilization ponds at a pH range of 6.8 to 7.4. The effluent has a pH range of 7.5 to 8.2. In the mid-1960's, the pH level of Johnstown effluents was extremely low (14.6). Company officials

indicated that the improvement is the result of segregation and collection of strong plant wastes into the chemical pond.

A drainage ditch runs along the perimeter of the west and south sides of the stabilization pond system and mixes with the pond effluent immediately downstream from the pond overflow weir. This drainage ditch was carrying a flow of about 100 gpm and was described, by Company officials, as being comprised of: (a) excess overflow from the plant raw water supply pond situated on the northwest corner of the plant property together with, (b) drainage from outlying agricultural fields north and east of the factory treatment ponds.

Waste loads have been proposed for this plant, under the Refuse Act Permit Program, based on "best treatment" for the sugar-beet processing industry on present plant capacity, and receiving water requirements. These limits are as follows:

1. BOD - not to exceed a total waste load of 1,000 lb/day;
2. Suspended solids - same requirement as for BOD; and
3. Fecal coliform bacteria - not to exceed 1,000 organisms/100 ml.

D. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

The effluent from the Johnstown plant was sampled continuously for three days commencing on December 8. Three 24-hr composites (equal volume composite) were collected (SERCO automatic sampler). Grab samples were collected periodically, from December 6 through 11, for bacteriological analyses, pH, conductivity, and temperature measurements. Water quality was also determined in the Little Thompson River upstream and downstream from the Great Western discharges. This was compared with

results of a stream survey conducted (Sept. 7-11, 1971) when the plant was closed for maintenance [Tables 1 and 2].

In December, as a result of the plant discharge, the BOD in the Little Thompson River increased by a factor of 20. The DO levels ranged from 10.6 to 10.7 upstream of the plant, but were decreased to as low as 4.0 mg/l downstream. Bacteria densities also increased from 360 to 6,900/100 ml. Dense slime growths covered the rocks and logs submerged in the stream. Sludge banks had formed; the bottom animal community was limited to pollution-tolerant organisms such as sludgeworms. Violations of the Basic Standards Applicable to All Waters of the State were occurring.

During the 1965[1/] survey, the Johnstown plant was discharging 11,900 lb of BOD per day to the river from two points. The fecal-coliform bacteria densities in the two discharges were 4,900 and 950,000 MPN/100 ml, respectively.

It was recommended at the reconvening of the Second Session of the *Conference in the Matter of Pollution in the South Platte River Basin*,[2/] that the total, 5-day BOD load from this plant not exceed 800 lb per day. The December 1971 survey indicated that the BOD load discharged to the Little Thompson River was more than 7,000 lb/day.

The company data [Table 3] indicates that the BOD and suspended solids loads that were discharged varied between 4,350-10,200 lbs and 2,280-3,000 lb/day, respectively, for the period November 1971-March 1972.

E. SUMMARY AND CONCLUSIONS

The Great Western Sugar Company Johnstown plant discharge caused violation of the Colorado Standards. The Basic Standards Applicable to All Water of the State were violated. The BOD and bacterial densities

TABLE 1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
LITTLE THOMPSON RIVER
SEPTEMBER AND DECEMBER 1971

Map Key	Station Description		Flow cfs	pH	Cond. µmhos/cm	Temp. °C	D.O. mg/l	BOD mg/l
September 7-10, 1971								
2	Little Thompson River at Route I-25, upstream of Great Western (RM 260.4/7.0/11.1)	Range Average		7.9-8.1	2,700-3,500 3,120	15-22	5.3-8.4 6.9	3.7-8.4 6.1
6	Little Thompson River at mouth, downstream from Great Western (RM 260.4/7.0/0.1)	Range Average	54.0-72.0 63.0	7.9-8.1	2,600-4,000 3,210	14-19	6.4-7.0 6.8	3.8-4.2 4.1
December 6-11, 1971								
3	Little Thompson River upstream of Great Western (RM 260.4/7.0/2.1)	Range Average	20.7	7.9-8.4	2,600-3,500 3,130	0-3	10.6-10.7	2.0-7.0 4.0
4	Effluent from Great Western (RM 260.4/7.0/2.8)	Range Average	4.2-4.8 4.4	7.3-8.5	1,050-2,550	5-11		267-320 297
5	Little Thompson River downstream from Great Western (RM 260.4/7.0/1.1)	Range Average	24.9-25.4 25.1	7.9-8.3	1,400-3,250 2,600	0.5-4.5	4.0-7.0 5.8	46.0-148 82.0

TABLE 2

SUMMARY OF BACTERIOLOGICAL RESULTS
LITTLE THOMPSON RIVER
SEPTEMBER AND DECEMBER 1971

Map Key	Station Description	Total Coliforms/100 ml			Fecal Coliforms/100 ml			Fecal Streptococci/100 ml		
		Maximum	Log Mean	Minimum	Maximum	Log Mean	Minimum	Maximum	Log Mean	Minimum
September 7-10, 1971										
2	Little Thompson River at Route I-25, upstream of Great Western (RM 260.4/7.0/11.1)	48,000	38,000	27,000	2,700	1,900	1,400	80,000	25,000	9,600
6	Little Thompson River at mouth, downstream from Great Western (RM 260.4/7.0/0.1)	48,000	41,000	35,000	3,500	2,300	1,300	22,000	14,000	6,100
December 6-11, 1971										
3	Little Thompson River upstream of Great Western (RM 260.4/7.0/4.0)	15,000	3,000	700	800	360	160	2,200	1,300	660
4	Effluent from Great Western (RM 260.4/7.0/2.8)				150,000	38,000	9,000	350,000	290,000	270,000
5	Little Thompson River downstream from Great Western (RM 260.4/7.0/1.1)	500,000	210,000	88,000	19,000	6,900	1,500	86,000	60,000	42,000

TABLE 3

DATA SUBMITTED BY THE GREAT WESTERN SUGAR COMPANY
FOR THE JOHNSTOWN PLANT DISCHARGE

Month	Mean Flow mgd	Temp. °C Range	pH Range	BOD mg/l[a/]	BOD lb/day	Suspended Solids mg/l[a/]	Suspended Solids lb/day	Total Coliforms MPN/100 ml	Total Coliforms MPN/100 ml	Fecal Streptococci MPN/100 ml
November 1971	4.35	12-13	7.5-7.8	282	10,200	63	2,280	595,000	14,000	43,000
December 1971	4.25	7-10	7.5-7.8	249	8,820	68	2,400	169,000	12,000	180,000
January 1972	4.51	6-8	7.2-8.4	230	8,650	77	2,900		1,000,000	
February 1972	2.72	8-12	7.1-8.4	348	7,680	107	2,400		9,600	
March 1972	4.2	15 Max.	7.4-8.3	124	4,350	85	3,000		2,755	

a/ These are net levels (effluent minus intake-concentration).

increased about 20 times from those observed upstream.

The data (both EPA and Great Western Sugar Company) indicate that the BOD load discharged during November 1971-March 1972 ranged from 4,350-10,200 lb, which is four to ten times greater than the load limit proposed for the Refuse Act Permit.

Compliance dates established for this plant in the Colorado Implementation Plan (December 31, 1969) and the South Plate River Basin Enforcement Conference (June 30, 1971) have not been met.

F. RECOMMENDATIONS

It is recommended that:

1. Waste load limits proposed for the Refuse Act Permit be met (i.e., BOD and suspended solids discharged shall not exceed 30 mg/l each, or 100 lb per day, whichever is less).

2. The effluent shall be regulated so that fecal coliform bacteria shall not exceed 1000/100 ml.

G. REFERENCES

1/ *The Beet Sugar Industry -- The Water Pollution Problem and Status of Waste Abatement and Treatment*, PR-8, U. S. Department of the Interior, Federal Water Pollution Control Administration, South Platte River Basin Project. Denver, Colorado. June 1967.

2/ *Report of the Second Session of the Conference in the Matter of Pollution of the South Platte River Basin*, U. S. Department of Health, Education, and Welfare, Federal Water Pollution Control Administration, South Platte River Basin Project. Denver, Colorado April 27, 1966.

GREAT WESTERN SUGAR COMPANY
LONGMONT MILL
LONGMONT, COLORADO

A. GENERAL

The Longmont sugar beet processing plant is a Steffen-house operation. The mill, in 1971, was operating at its rated capacity of 3,307 tons of sugar beets sliced per day and 185 tons per day of processed molasses. Employment during the campaign involved 265 persons.

An extensive waste source survey was conducted at the Longmont plant in November 1965 with an addition in November 1966.[1/] The later study was carried out in order to determine any water quality changes resulting from the construction of a treatment lagoon for total plant wastes. The investigation revealed that, in the effluent, both the suspended solids and the temperature were significantly lowered, but dissolved organics and bacteria densities were at the same levels, or had increased.

It was recommended[2/] that the waste discharge from this mill be limited to 1,450 lb per day each of BOD and SS. At the reconvened second session of the *Conference in the Matter of Pollution in the South Platte River Basin* (Denver, Colorado, November 10, 1966) the Conferees recommended that all waste discharges (to basin waters) install adequate remedial or control facilities by June 30, 1971, in order to comply with the water quality standards that were being a) established by the State of Colorado Water Pollution Control Commission and b) approved by the Secretary of the Interior. The Commission subsequently set a compliance date of December 31, 1968, at which time this industry was to have adequate treatment.

In 1968, the Company constructed a "closed" flume water recycle system. Studies by the Colorado State Department of Health, in 1969-70, indicated that the condenser water discharged raised the temperature of St. Vrain Creek from 10°C to 20°C. Seepage from the waste lagoons was septic and lowered the dissolved oxygen of St. Vrain Creek.[3/]

Water pollution control practices were evaluated by the National Field Investigations Center-Denver (NFIC-D) during December 1971. The Great Western officials contacted were: Ralph Bristol, factory manager; Robert Barker, master mechanic; and Gary Maggie, district factory engineer (Johnstown).

B. WATER SUPPLY AND USES

St. Vrain Creek water is completely diverted to the mill just upstream of the Longmont wastewater treatment plant outfall (RM 22.5). After the mill uses about 9.1 mgd of the creek water, any excess of the diverted water, after being mixed with condenser water, overflows to the stream (RM 22.0). This surface (creek) water is augmented by City of Longmont water (0.75 mgd). The latter is primarily employed for sanitary needs, Company lawn irrigation, the centrifugal wash, emergency feed on the boilers, and feed for the barometric condenser.

C. WASTE SOURCES AND TREATMENT

Condenser water is the major discharge from the mill and the only one for which the Great Western Sugar Company has applied for a Refuse Act Permit. The volume of discharge averaged 7.3 mgd during the study period, December 6 through 10, 1971.

A drain collects seepage from the lime and flume-water surge pond area. During the survey, the flow from this drain was approximately 1 cfs.

The "closed" flume water disperses about 6,000 gpm of water, maintained between pH 8 and 9 by the daily addition of four to five tons of lime. The flume water (6,000 gpm) is passed through a screen station (six, at 6 ft by 7 ft); then a portion (2,000 gpm) is diverted into the primary and secondary settling basins [Figure 1]. The two kidney-shaped primary settling ponds (each approx. 400 ft long by 50 ft wide across the top and 20 ft wide across the bottom) are alternately used to enable sluicing of the excess basin muds into the mud sluice pond. Effluent from the primary settling ponds enters the secondary settling basin (donut-shaped, approx. 100 ft by 250 ft).

Overflow from the secondary basin is re-used at various points in the flume water system. Any excess water from the secondary basin discharges to an anaerobic surge basin (approx. 300 sq ft by 15 ft in depth) that is equipped with two 5-hp aerators. During a plant inspection on December 1, 1971, strong odors were emanating from this area. This anaerobic surge basin can be emptied for cleaning by flushing its contents to surge pond No. 1.

Excess flume water from the "closed" circuit is bypassed to surge pond No. 1 together with general plant wastes, boiler blowdown, various laboratory wastes, acid boilouts, and some floor and yard drains. According to Company officials, dumps and spills in the juice end of the plant are collected in a sump inside the mill and re-used at the first carbonation station. Steffen-house drains either return to the juice

area for recovery or are discharged into the flume circuit. Floor drains of the CSF are primarily directed to surge pond No. 1. The northwest corner of surge pond No. 1 is equipped with a standpipe that transfers flow to surge pond No. 2.

Gas-scrubbing effluent from the lime kiln area is discharged into the closed, flume-water circuit. Lime mud wastes are slurried and deposited into a lagoon. The Company also uses two ash ponds which are fairly extensive. Both were full at the time of the inspection; there was little freeboard available, particularly on the southeast corner of pond No. 2. The EPA investigators judged the dikes of these ponds to be lacking in structural stability. There was a well defined seep flow originating from the southeast corner of pond No. 2. Overflow from these ponds enters the water supply pond.

Limits on waste loads have been proposed for this mill, under the Refuse Act Permit Program, bas d on "best treatment" for the sugar-beet processing industry and on present plant capacity. These loads are as follows:

1. BOD - not to exceed 0.5 lb/ton of beets sliced or 1,650 lb/day, whichever is less.
2. Suspended Solids - same limits as for BOD.
3. Fecal coliform bacteria - if pathogenic organisms are demonstrated to be present in the discharge, the effluent shall be regulated so that fecal coliform bacteria shall not exceed 1000/100 ml.

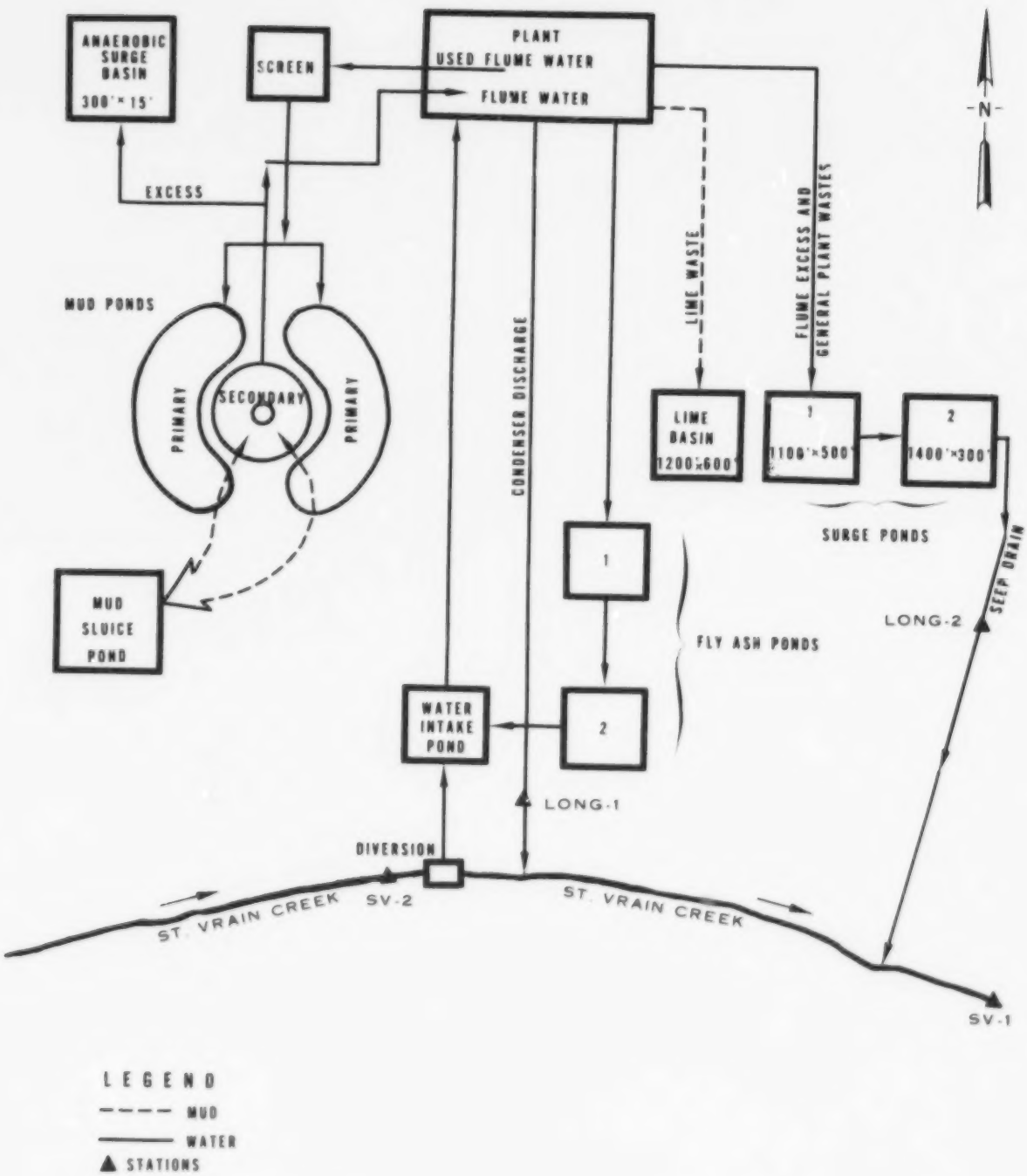

Figure 1 Plant Schematic and Sampling Stations Great Western Sugar Company Longmont, Colorado

D. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

An in-plant evaluation was conducted during December 6 through 10, 1971. Three 24-hr composite samples were collected at selected discharge points [Stations LONG-1* and LONG-2, Figure 1] using SERCO automatic samplers. Periodic measurements were made of the pH, conductivity, and temperature, and grab samples were collected daily for bacterial analyses. Two stream stations (SV-1 and SV-2) were also sampled daily on a grab basis and analyzed for the same variables.

Results [Tables 1 and 2] indicate that an effluent containing about 2,520 lb per day (0.80 lb/ton)** BOD was discharged to the stream. At the time of the survey the Longmont Wastewater Treatment Plant was discharging about 4.0 mgd of effluent, containing 2,100 lb BOD, to St. Vrain Creek just downstream (RM 22.5) from the point of diversion for the Great Western water supply.

The stream survey showed that the result of this combination, wastes from the treatment plant and from Great Western mill, was a violation of the DO criterion (3.0 mg/l). Temperatures were increased by as much as 13°C, also as a result of these discharges.

Downstream from them, large sludge beds have formed. *Sphaerotilus*, a filmentous bacterium, covered much of the stream bottom with dense growths.

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* The Company has applied for only one Refuse Act Permit. This is for the condenser water discharge (Station LONG-1). During the survey, the drain collecting seepage from the lime and surge ponds had a fairly constant flow. Moreover, the Company apparently has the need to periodically discharge from the overall treatment system. If these discharges cannot be eliminated through improved waste management, then permits should be obtained for them.

** Company data for the 1971-72 campaign indicate that the pounds BOD per ton of beets sliced ranged from 0.29-0.78.

TABLE 1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
DECEMBER 6-10, 1971

Station	Description		Flow mgd	Temp. °C	Cond. µmhos/cm	pH	Dissolved Oxygen mg/l	Dissolved Oxygen % Sat.	BOD mg/l	Alkalinity mg/l
SV-1	St. Vrain River downstream from Great Western Co. (RM 270.0/20.6)	Range	33.6-37	5.0-13.0	1,200-1,380	7.7-8.4	0.3-3.7	3-33	45-65	230-265
		Average	36				2.1		55	251
SV-2	St. Vrain River upstream of Great Western Co. (RM 270/22.5)	Range	22.4-26	0.0-1.0	825-1,350	7.7-8.3	10.4-12.6	85-106	2-6	198-230
		Average	25				11.3		3	214
LONG-1	Condenser water effluent (RM 270.0/22.0)	Range	6.7-9.4	30.0-46.0	950-1,300	8.1-9.2			30-54	205-225
		Average	7.3						46	213
LONG-2	Seep drain from lime and surge pond area (RM 270.0/20.9)	Range		0.0-6.5	1,400-2,200	7.5-8.4			5-8	197-661
		Average	0.65						6.7	498

TABLE 2
SUMMARY OF BACTERIOLOGICAL RESULTS

Station	Total Coliforms/100 ml			Fecal Coliforms/100 ml			Fecal Streptococci/100 ml		
	Maximum	Log Mean	Minimum	Maximum	Log Mean	Minimum	Maximum	Log Mean	Minimum
SV-1	740,000	>40,000	940	96,000	1,300	10	81,000	12,000	810
SV-2	2,100	1,200	570	270	190	84	2,300	930	560
LONG-1				250	38	10	39,000	9,700	1,200
LONG-2				440	<33	<10	53,000	7,500	2,300

These conditions represent violations of Sections B and D of the Colorado Basic Standards Applicable to All Waters of the State.

E. SUMMARY AND CONCLUSIONS

1. In Longmont, the waste loads from the Great Western mill in combination with those from the treatment plant caused violation of the DO criterion and of the Basic Standards Applicable to All Waters of the State.

2. The condenser water discharge (30°-46°C) raised the temperature of St. Vrain Creek by as much as 13°C.

3. Analytical results indicated that the mill discharged about eight tenths of a pound of BOD per ton of beets, a figure that exceeds the effluent quality (0.5 lb BOD/ton) achievable by installation of "best treatment".

4. The mill has two continuous discharges (seepage and condenser-water) and makes periodic discharges from the flume-water treatment system. Improved waste management could eliminate the need for such discharges.

5. Excessive seepage (icfs) occurs through the dikes of the waste-water storage ponds.

F. RECOMMENDATIONS

It is recommended that:

1. The waste load limits proposed for the Refuse Act Permit be met (i.e., BOD and suspended solids shall not exceed 0.5 lb/ton of beets processed or 1,650 lb/day, whichever is less; and, if pathogenic organisms are demonstrated to be present in the discharge, the effluent shall be regulated so that fecal coliform bacteria shall not exceed 1000/100 ml).

2. All wastewater ponds be constructed in accordance with best engineering practices in order to prevent excessive seepage and to preclude the possibility of dike failure.

3. Improved waste management techniques be implemented to eliminate periodic discharges from the flume-water treatment system.

G. REFERENCES

1. *The Beet Sugar Industry -- The Water Pollution Problem and Status of Waste Abatement and Treatment*, PR-8, U. S. Department of the Interior, Federal Water Pollution Control Administration, South Platte River Basin Project, Denver, Colorado, June 1967.

2. *Report to the Second Session of the Conference in the Matter of Pollution of the South Platte River Basin*, U. S. Department of Health, Education, and Welfare, Federal Water Pollution Control Administration, South Platte River Basin Project, April 27, 1966.

3. *Water Pollution Survey of the Great Western Sugar Company and the Kuner-Empson Canning Company of Colorado*, Colorado Water Pollution Control Commission, November 24, 1969 to March 11, 1970.

GREAT WESTERN SUGAR COMPANY
LOVELAND MILL
LOVELAND, COLORADO

A. GENERAL

The Loveland mill is a Steffen-house operation and prepares CSF -- for shipment to the Great Western plant at Johnstown. As of December 1, 1971, the average process rate was 3,900 tons per day sugar beets sliced and 200 tons per day non-Steffen molasses. Loveland also produces 200 tons per day of molasses (for shipment to Johnstown). The total employment during the campaign was about 265 people; 30-50 people are employed during the remainder of the year.

During the 1963-64 campaign, two treatment fields provided for the processing of waste; the primary cell was 92 acres and the secondary cell was 41 acres. Wastewater flowed through the primary cell in numerous shallow channels and was transferred through three culverts to the secondary cell; effluent then flowed to a ditch and subsequently to the Big Thompson River.[1/] The effluent BOD measured 510 mg/l (15 lb/ton of beets processed), a value that represented a reduction of about 25 percent in the treatment fields. (An earthen dike was constructed in the primary cell in 1965-66 to preclude short circuiting.)

At the second session of the *Conference in the Matter of Pollution of the South Platte River Basin* it was recommended that BOD and suspended solids in the effluent not exceed 1,750 lb per day each.[2/]

A study[3/] by personnel of the Colorado State Department of Health during the 1969-70 campaign indicated that the Loveland mill was violating

water quality standards (i.e., treatment providing less than 80 percent removal of BOD).

Capital expenditures for waste treatment/control facilities at Loveland were $200,000 in 1970 and $300,000 in 1971. Present treatment consists of mechanical clarification and recycle of all flume-water. Only the condenser water is discharged to the Big Thompson River.

The Loveland mill was evaluated for water pollution control practices by the National Field Investigations Center-Denver (NFIC-D) personnel on December 1, 1971. The Great Western Company officials providing information and assistance were: Dan Conwell, plant manager; Nick Watson, district engineer, Johnstown; Gary Maggie, district plant engineer (Johnstown).

B. WATER SUPPLY AND USES

The water supply is from two sources: (1) surface water diverted from the Greeley-Loveland canal (averages 11.2 mgd) and (2) City of Loveland water (averages 1.0 mgd). Water is used to cool barometric condensers and to supplement losses to the "closed" flume system. City water is used for emergency boiler feed, sanitary needs, turbine packing, and for the CSF operations.

C. WASTE SOURCES AND TREATMENT

The Loveland mill has a "closed" flume-water recycle system of limited efficiency. The circulated flume-water is pumped over three link-belt vibrating screens (5 ft by 12 ft) operating in parallel. Then, by gravity, the flow is channelled into an EIMCO clarifier (90 ft) [Figure 1]. Effluent from the clarifier is recycled and settled muds

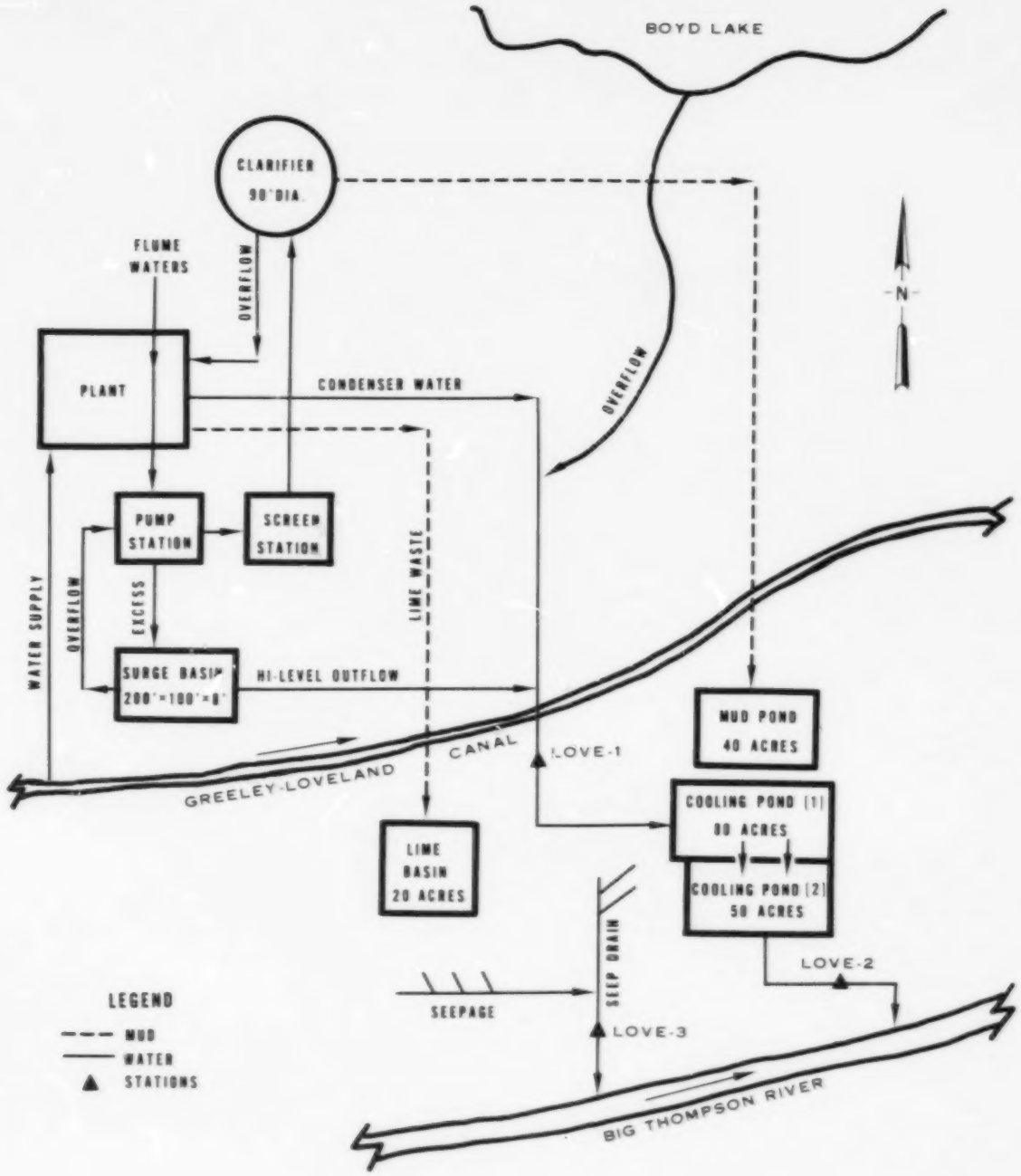

Figure 1.Plant Schematic and Sampling Stations Great Western Sugar Company Loveland,Colorado

(approx. 500 gpm) are discharged into a 40-acre mud pond (non-overflowing), located two miles east of the mill. Wastewaters from floor and yard drains are discharged into the "closed" flume-water system.

Normal flow on the "closed" flume-water system ranges from 6,000 to 8,000 gpm. Two tons of lime are added daily to the flume-water circuit in order to hold the pH level above 7.0. Surges occur in the circuit: at such times the flow increases up to 10,000 gpm. When this happens, the excess flow is pumped to a surge basin (200 ft by 100 ft by 8 ft). Any overflow from this basin is returned to the pump house for recirculation.

Condenser waters and ashes from the boilers are conveyed in an open ditch, approximately two miles east of the plant, to where this waste flow intercepts overflow from Boyd Lake. The entire flow is discharged into two cooling ponds operating in series -- the first covers about 30 acres and the second about 50 acres [Figure 1]. Overflow from the second pond flows, by means of a three-quarter mile long ditch, to the Big Thompson River.

Lime muds are carried in a separate pipeline east of the plant and are discharged to a 20-acre, non-overflowing pond located directly west of cooling pond No. 1. Considerable seepage was observed over large downslope areas surrounding the lime pond and the cooling ponds.

Waste loads have been proposed for this plant under the Refuse Act Permit program. These loads are based on "best treatment" for the sugar-beet processing industry, present plant capacity, and receiving water requirements. These requirements are as follows:

1. BOD - not to exceed 0.35 lb/ton of beets sliced or 1,850 lb/day, whichever is less:

2. Suspended solids - same as that for BOD: and
3. Fecal coliform bacteria - if pathogenic organisms are demonstrated to be present in the discharge the effluent shall be regulated so that fecal coliform bacteria shall not exceed 1000/100 ml.

D. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

A plant evaluation was conducted at this mill in December 1971. Three 24-hr composite samples were collected, with SERCO automatic samplers, at selected stations [Figure 1]. Periodic measurements were made of the pH, conductivity, and temperature; daily grab samples were collected for bacterial analyses.

Results of the analyses [Tables 1 and 2] show that the BOD and SS of the main discharge (Station LOVE-2) averaged 13 mg/l (0.22 lb/ton) and 23 mg/l (0.4 lb/ton), respectively. Data furnished by the Company for the 1971-72 campaign indicated that the maximum number of pounds of BOD and SS discharged per ton of beets processed was 0.24 and 1.34, respectively. Water pollution control practices have improved significantly from those found during the 1963-64 campaign. At that time the mill was discharging an effluent containing more than 50,000 pounds of BOD per day. It was the major source of pollution in the Big Thompson River.

As noted earlier, seepage was observed in the areas surrrounding the lime and cooling ponds. Analysis of this seepage (0.13 mgd) from the lime pond area [Table 1] indicated that this BOD value is higher (100 mg/l) than that (65 mg/l) of the main discharge.

TABLE 1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
DECEMBER 6-10, 1971

Station	Description		Flow mgd	Temp. °C	Alkalinity mg/l	Cond. µmhos/cm	pH	BOD mg/l	Susp. Solids mg/l
LOVE-1	Condenser water plus Boyd Lake overflow	Range	9.1-11.4	15.0-20.0	140	470-590	8.4-9.2	54-65	510-1,210
		Average	10.0					58	860
LOVE-2	Cooling pond effluent	Range	6.7-9.4	0.0-5.0	130	520-650	7.9-8.2	6-18	5-60
		Average	7.6					13	23
LOVE-3	Seepage from lime pond	Range	0.13	3.5-10.0	658	1,350-1,650	7.2-7.8	14-100	15-50
		Average						51	28

TABLE 2

SUMMARY OF BACTERIOLOGICAL RESULTS

Station	Description	Fecal Coliforms/100 ml				Fecal Streptococci/100 ml		
		Maximum	Log Mean	Minimum	% Samples >2000	Maximum	Log Mean	Minimum
LOVE-2	Cooling pond effluent	32	<8	<4	0	110,000	2,200	310
LOVE-3	Seepage from lime pond	20	<9	<4	0	4,700	1,400	550

E. SUMMARY AND CONCLUSIONS

The data indicate that the Loveland mill was providing adequate treatment of its surface discharges during the 1971-72 campaign (0.22 lb of BOD/ton of beets processed). This represents a significant reduction from the waste loads discharged during the 1963-64 campaign (15 lb of BOD/ton of beets processed).

Seepage (0.13 mgd) from the wastewater ponds was observed during the in-plant evaluation in December 1971. Analyses of the seepage from the lime-mud pond area showed it had a higher BOD value (100 mg/l) than that from the main discharge (65 mg/l).

F. RECOMMENDATIONS

It is recommended that:

1. The limits proposed for the Refuse Act Permit be met at this mill (i.e., the BOD and SS discharged shall not exceed 0.35 and 0.5 lb, respectively, per ton of beets processed or 1,300 and 1,850 lb/day, respectively, whichever is less, and, if pathogenic organisms are demonstrated to be present in the discharge, the effluent shall be regulated so that fecal coliform bacteria shall not exceed 1000/100 ml.

2. Waste ponds be constructed in accord with best engineering practices to preclude excessive seepage and possible dike failures.

G. REFERENCES

1/ *The Beet Sugar Industry -- The Water Pollution Problem and Status of Waste Abatement and Treatment*, PR-8, U. S. Department of the Interior, Federal Water Pollution Control Administration, South Platte River Basin Project. Denver Colorado. June 1967.

2/ *Report to the Second Session of the Conference in the Matter of Pollution of the South Platte River Basin*, U. S. Department of Health, Education, and Welfare, Federal Water Pollution Control Administration, South Platte River Basin Project. April 27, 1966.

3/ *Water Pollution Survey of the Great Western Sugar Company and the Holly-Sugar Corporation Company of Colorado*, Colorado Water Pollution Control Commission. November 24, 1969 to March 11, 1970.

GREAT WESTERN SUGAR COMPANY
STERLING MILL
STERLING, COLORADO

A. GENERAL

The Sterling sugar-beet processing mill is a straight-house operation. End molasses from this operation is shipped to Fort Morgan. Liquid protein concentration (LPC) from Johnstown and some processed molasses from Fort Morgan are added in the dried beet-sugar pulp production. The plant is rated at 2,435 tons of sugar beets per day. During November the plant was processing an average of 2,590 tons of sugar beets per day. The campaign started October 4, 1971, and ended about January 20, 1972. Total employment during this campaign was about 200 persons.

The Sterling plant discharged an effluent containing more than 42,000 lb BOD per day (19 lb/ton of beets processed) in December, 1963.[1/] Installation of a truck hopper that requires no water resulted in a reduction of the wastewater discharged. During 1967 pollutional loads associated with pulp silo wastes were eliminated because of pulp pressing and drying facilities. Great Western officials reported that approximately $500,000 were spent during 1970 and 1971 both for waste separation and improvement of the treatment system. A "partial" recycle, flume-water system is now used. About 25 percent of the flume water is treated by aerated lagoons and settling basins and then discharged to the South Platte River.

Water pollution control practices at this Great Western plant were evaluated by personnel of the National Field Investigations Center-Denver

(CFIC-D) November 29 through December 3, 1971. Information and assistance was provided by Great Western Superintendent Nick Shyne and Ray Kaiser, a district engineer.

B. WATER SUPPLY AND USES

Mill water is supplied by the adjacent Sterling No. 1 irrigation canal (4.8 mgd); Company-owned wells (4.8 mgd); and by Sterling city water (0.3 mgd). City water is used for sanitary demands, emergency boiler feed, and other, minor plant needs. The canal- and well-water provide condenser water (4.4 to 7.3 mgd daily) and augment flume-water losses (600 to 800 gpm).

C. WASTE SOURCES AND TREATMENT

The single discharge to the South Platte River consists of: excess canal water not used for water supply; treated plant wastes from both the aeration lagoons and polishing pond; and condenser cooling-water [Figure 1]. The volumes of treated mill wastes and condenser water discharged are 600 to 800 gpm and 3,000 to 5,000 gpm, respectively. Sanitary waste is discharged into the Sterling municipal waste treatment system. Acid and caustic boilouts, boiler blowdown, and other strong wastes are discharged into a holding pit (non-overflowing). Lime muds from the purification and filtration process are stored in a 8-acre, non-overflowing pond. Flow surges in the flume circuit that are too large for the treatment system are discharged into the non-overflowing surge pond (130 ft by 360 ft).

Condensates from the first and second evaporator effects are re-used

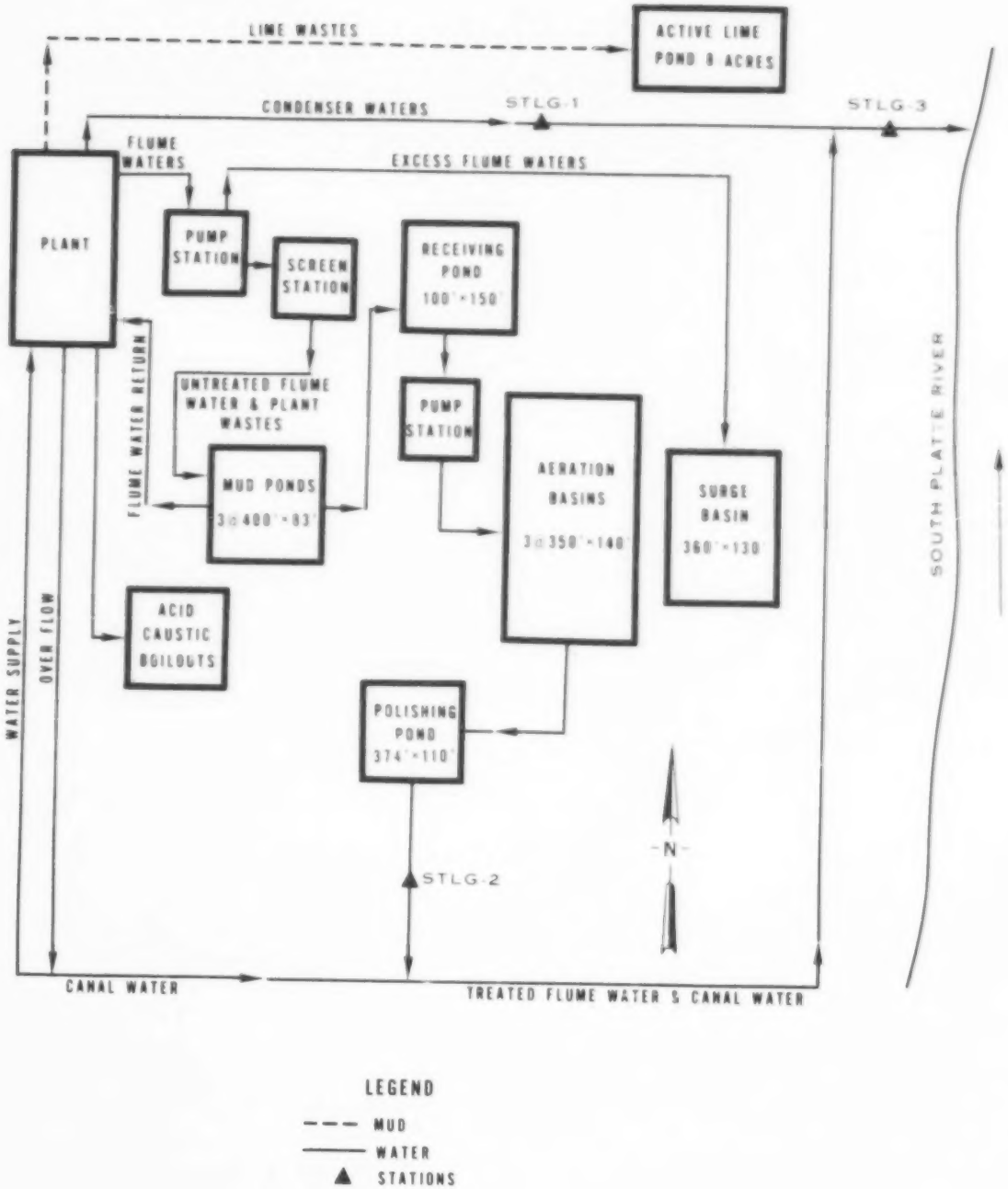

Figure 1.Plant Schematic and Sampling Stations Great Western Sugar Company Sterling.Colorado.

as boiler supply and press wash. Condensates from the third and fourth effects are directed to various hot-house uses. Direct condensate discharge from the mill originates primarily from the fifth-effect evaporator condenser and from vacuum-pan condensers.

Flume-water and general plant wastes are directed into the treatment re-use system. Water (approx. 3,000 gpm) is circulated through the flume system. No line is added for pH adjustment. Flume-water leaves the northeast side of the plant by means of a ditch and is lifted over a series of three, travelling link-belt screens (8 ft by 5 ft with 1/4 in. openings). Flume-water then enters into a mud-settling recirculation system comprised of three separate ponds (each, 400 ft by 83 ft by 10 ft). The water enters one of the outside ponds and flows into the middle pond. The overflow from the middle pond returns to the flume system. The remaining outside pond receives no flow until it is necessary to remove the settled muds from the other outside pond. Approximately 80 percent of the overflow from the middle pond is recycled into the flume circuit. The remainder (600 to 900 gpm) is conveyed through the mill waste treatment system in the following sequence: a) a small receiving pond (100 ft by 150 ft); b) three aeration ponds (each 350 ft by 140 ft by 13 ft), which can operate in parallel or in series, with two floating 50-hp aerators in each; and c) a polishing pond (374 ft by 110 ft by 5 ft) with a 10-hp aerator positioned at the inlet.

D. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

A waste-source survey was conducted at the Sterling mill from November 29 to December 3, 1971. Three 24-hr composite samples

(composited on an equal volume basis using SERCO automatic samplers) were collected at selected stations [Figure 1]. Grab samples were collected daily for bacteriological analyses. The pH, conductivity, and temperature were measured periodically. Results [Tables 1 and 2] showed that the bacterial quality of the main canal discharge (STLC-3) was low in fecal coliforms (370/100 ml)* but high in fecal streptococci (>860,000/100 ml). The BOD and SS in the main canal discharge (17.9 cfs) were 2,310 lb (0.9 lb/ton) and 3,640 lb (1.5 lb/ton) per day, respectively.

A stream survey was also conducted on the South Platte River during the in-plant evaluation. Downstream from the main discharge the stream was severely polluted. Massive growths of slimes and algae covered the rocks and other submerged objects. Pollution was so intense in this reach that the pollution-tolerant sludgeworms were virtually eliminated (reduced from 752/sq ft upstream to 6/sq ft).

Data provided by the Company indicated that during the 1971-72 campaign the BOD of the main discharge ranged from 15-211 mg/l (average 75 mg/l). The net BOD load discharged (subtracting out the BOD of the intake water) ranged from 0.4 to 4.7 lb per ton. An effluent containing one-half pound per ton each of BOD and suspended solids is achievable through the installation of "best treatment."** The flow data reported by the Company showed the discharge ranged from 4.6-8.1 mgd, significantly lower than that measured during the in-plant survey (11.6 mgd).

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* Bacteria densities are the log mean, unless otherwise noted.

** Waste loads, proposed for this mill under the Refuse Act Permit Program, are based on "best treatment" for the sugar-beet processing industry, present plant capacity, and receiving water requirements. Loads for BOD and SS are 0.5 lb each per ton of beets sliced, not to exceed 1220 lb per day of each. In addition, if pathogenic organisms are demonstrated to be present in the discharge, the effluent shall be regulated so that fecal coliform bacteria shall not exceed 1000/100 ml.

TABLE 1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
NOVEMBER 29-DECEMBER 3, 1971

Sta. No.	Station Description		Flow mgd	Temp. °C	Cond. μmhos/cm	pH	BOD mg/l	Total Solids mg/l	Suspended Solids mg/l	Alkalinity mg/l
STLG-1	Condenser discharge	Range	7.0-7.5	20.0-29.0	1,500-2,600	8.6-8.8	18-36	1,300-1,570	10-100	258-281
		Average	7.2				24	1,450	50	270
STLG-2	Effluent from transport system	Range	0.23-1.2	11.0-15.0	1,400-1,900	7.5-8.8	180-300	2,030-2,130	220-1,300	514-541
		Average	0.50				250	2,160	740	529
STLG-3	Main canal discharge	Range	10.9-12.2	11.0-15.0	1,400-1,900	8.4-8.6	19-26	1,170-1,640	20-60	279-288
		Average	11.6				24	1,400	40	283

TABEL 2

SUMMARY OF BACTERIOLOGICAL RESULTS

Sta. No.	Station Description	Fecal Coliforms/100 ml				Fecal Streptococci/100 ml		
		Maximum	Log Mean	Minimum	% Samples >2000	Maximum	Log Mean	Minimum
STLG-3	Main canal discharge	810	370	150	0	1,600,000	>860,000	>100,000
STLG-2	Effluent from transport system	6,300	3,700	900	80	7,900,000	>1,000,000	>100,000
STLG-1	Condenser water discharge	110	<42	28	0	60,000	5,000	490

E. SUMMARY AND CONCLUSIONS

1. The waste load from the Sterling mill has been reduced significantly since 1963 when the load was measured at 42,000 lb BOD per day. Available data (EPA and the Great Western Sugar Company) indicate that the number of pounds of BOD per ton of beets processed varied from about 0.4 to 4.7.

2. Maximum fecal-coliform bacteria densities in the main discharge were less than 1,000/100 ml during the in-plant survey.

F. RECOMMENDATIONS

It is recommended that the following limits proposed for the Refuse Act Permit be met at this mill:

1. The BOD and suspended solids loads from the plant not exceed 0.5 lb each per ton of beets processed or the total load of each discharged not exceed 1,220 lb per day, whichever is less.

2. If pathogenic organisms are demonstrated to be present in the discharge, the effluent shall be regulated so that fecal coliform bacteria shall not exceed 1,000/100 ml.

G. REFERENCE

1/ *The Beet Sugar Industry -- The Water Pollution Problem and Status of Waste Abatement and Treatment*, PR-8, U. S. Department of the Interior, Federal Water Pollution Control Administration, South Platte River Basin Project. Denver, Colorado. June 1967.

LOVELAND PACKING COMPANY
1000 SOUTH LINCOLN STREET
LOVELAND, COLORADO

A. GENERAL

The Loveland Packing Company, which employs 75 persons and operates on a 40-hr week, slaughters approximately 1,500 hogs and processes three tons of beef per week. Edible and inedible parts are rendered. In addition, 300 hogs are fed within the plant area.

Water (50,000 gpd) obtained from the City of Loveland is used for cooking, plant cleaning, processing of carcasses, and domestic use.

In 1965[1/] this company was processing approximately 100 head of cattle and 250 hogs per week. However, wastewater treatment facilities have not been expanded in conjunction with overall plant expansions.

The water pollution control practices of this packing plant were evaluated by personnel from the National Field Investigations Center-Denver (NFIC-D), September 26 to 30, 1971. Ronald Miltonburger, a company official, provided information and assistance.

B. WASTE SOURCES AND TREATMENT

All process wastewaters receive treatment in a 65,000-gpd wastewater treatment facility. The facilities consist of a grease trap that is skimmed daily; a shaker screen to remove solids; an aeration basin equipped with one aerator; a clarifier; and a polishing basin. The effluent from the plant flows, by means of a small stream, to the Big Thompson River (RM 260.4/25.5).

Washdown water from the hog pens is discharged into an evaporative

lagoon. At the time of the 1971 investigation there was a small amount of water in the lagoon.

C. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

Four grab samples each of the wastewater treatment plant influent and effluent were collected during September 29 and 30, 1971. Temperature, pH, and conductivity were measured each time a sample was collected. Flows were estimated from water-use information [Table 1].

There is a daily effluent containing 43 lb of BOD (0.64 lb/1,000 lb LWK*) and 39 lb of suspended solids (0.58 lb/1,000 lb LWK) discharged to the Big Thompson River. Waste loads have been proposed for this industry under the Refuse Act Permit Program. These loads are based on "best treatment" for the meat processing industry, present plant capacity, and receiving water requirements. These requirements are as follows:

1. BOD shall not exceed 0.14 lb/1,000 lb LWK or 15 lb/day, whichever is less;
2. suspended solids shall not exceed 0.1 lb/1,000 lb LWK or 15 lb/day, whichever is less; and
3. The fecal-coliform bacteria density shall not exceed 1,000/100 ml.

D. SUMMARY AND CONCLUSIONS

The present discharge containing 0.64 lb BOD per 1,000 lb LWK and 0.58 lb suspended solids per 1,000 lb LWK is not in accord with "best treatment" available for the meat processing industry.

* This figure is based on current production of 67,500 lb/day.

TABLE 1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
LOVELAND PACKING COMPANY WASTEWATER TREATMENT PLANT
SEPTEMBER 28-30, 1971

Parameter[a]	Influent		Effluent	
	Range	Average	Range	Average
Flow (mgd)[b]				0.05
pH	6.8-7.6		7.5-7.7	
Temperature (°C)	22-24		14.5-15.0	
Cond. (µmhos/cm)	700-2,200		1,200-1,600	
Total Solids	710-1,720	1,140	650-1,730	890
SS	120-640	492	22-198	94
Oil & Grease			14-22	17
TOC	260-540	373	70-180	83
COD	440-540	500	120-145	135
BOD	530-1,770	1,077	40-240	105

a/ All units of measurement are in mg/l unless otherwise noted.
b/ This value is obtained from water-use records.

E. RECOMMENDATIONS

It is recommended that appropriate abatement actions be taken to ensure that the Loveland Packing Company provide "best treatment" to produce an effluent which meets the following limits:

1. The effluent contain no more than 0.14 lb of BOD per 1,000 lb LWK or 15 lb per day, whichever is less.

2. The effluent contain no more than 0.1 lb of suspended solids per 1,000 lb LWK or 15 lb per day, whichever is less.

3. The fecal-coliform bacteria density of the effluent not exceed 1,000/100 ml.

F. REFERENCE

1/ *A Study of Industrial Waste Pollution in the South Platte River Basin*, PR-6B, U. S. Department of the Interior, Federal Water Pollution Control Administration, South Platte River Basin Project. Denver, Colorado. December 1966.

MARTIN MARIETTA CORPORATION
P. O. BOX 179
DENVER, COLORADO 80201

A. GENERAL

Martin Marietta, the largest manufacturer of aerospace hardware in the metropolitan Denver area, employs between 11,000 and 12,000 people on a 40-hr work week. Water is obtained from the City of Denver for all uses within the plant.

A study conducted in 1964[1/] indicated that this company was providing adequate wastewater treatment.

Water pollution control practices were evaluated by personnel of National Field Investigations Center-Denver (NFIC-D) on September 29 and 30, 1971. Company officials who provided information and assistance were: Ross D. Miller, facilities manager; Peter D. Kaunitz, safety and facilities engineer; Thomas W. Johansen and D. Griffiths, maintenance and water effluent engineers; Jerold M. Bidwell; Dr. Rex E. Paulsen; George P. Fulton; and Robert B. Morgan

B. WASTE SOURCES AND TREATMENT

Industrial and domestic wastes are treated in separate treatment facilities. The sanitary wastewater treatment plant consists of a primary clarifier, a two-stage trickling filter with an intermediate clarifier, and a final clarifier. The chlorinated effluent is discharged to Brush Creek (RM 341.1/210) a tributary to the South Platte River.

Industrial wastes, primarily from plating operations, are discharged into holding tanks (four 20,000 gal. and four 60,000 gal.) for treatment.

Acidic, alkaline, and cyanide wastes are treated with lime, sulfuric acid, and sodium sulfite, respectively. Wastewaters that contain hexavalent chromium are treated with either sodium sulfite or sulfur dioxide (used when the chromium concentration exceeds 2.5 mg/l) to reduce the chromium ion to the trivalent form. Lime is then added to bring the pH to 9.0 in order to precipitate chromium hydroxide. The precipitate and any wastewaters not otherwise treated are discharged into two lagoons. The remaining liquid is tested and, if found to be adequately treated, is discharged to Brush Creek.

On June 7, 1971, Martin Marietta signed a contract with the Martin K. Eby Construction Company to repair and improve the operation of the industrial treatment facility. Improvements scheduled to be completed by February 1972 include:

a) modification of the acid and alkaline holding tanks;

b) modification of the chemical feeding system with a new chemical control and storage building;

c) modification of sedimentation tanks;

d) a new sludge-pumping station;

e) modification of an emergency holding pond; and

f) construction of an evaporation pond and a force main.

C. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

Grab samples of the industrial effluent were collected daily on September 29 and 30. Temperature, pH, and conductivity were measured each time a sample was collected [Table 1]. Company records show that

TABLE 1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
MARTIN MARIETTA CORPORATION
SEPTEMBER 29-30, 1971

Parameter[a/]	Average	Range
Flow (gal.)[b/]	30,000	
Temperature (°C)		23-26
Cond. (µmhos/cm)		1,000-1,700
pH		7.2-7.3
Oil & Grease	27	
COD	66	
TS	1,110	1,080-1,140
SS	65	50-80
BOD	23	5-40
NH_3, as Nitrogen	0.7	
Total Kjeldahl Nitrogen (as N)	5.3	1.5-9.0
Nitrites and Nitrates (as N)	3.3	2.9-3.6
Total Phosphorus	0.65	0.6-0.7
Metals		
Cadmium	<0.1	
Chromium	0.56	0.52-0.60
Copper	0.18	0.16-0.20
Lead	<0.05	
Zinc	0.09	0.08-0.10

a/ All units of measurement are in mg/l unless otherwise noted.
b/ This value represents average flow per release.

an average of four 30,000 gal. releases are discharged daily to Brush Creek.

The effluent contained high levels of oil and grease (27 mg/l) and suspended solids (65 mg/l). The heavy-metals concentrations are relatively low and should not cause an adverse effect on the receiving waters.

D. SUMMARY AND CONCLUSIONS

1. The effluent from the treatment facility contained large amounts of suspended solids and oil and grease.

2. The Company has modified the industrial wastewater treatment facilities to produce a better effluent.

E. RECOMMENDATIONS

It is recommended that appropriate water pollution control measures be taken by Martin Marietta Corporation to ensure that the amounts of oil and grease and suspended solids are reduced to 10 mg/l and 30 mg/l, respectively.

F. REFERENCE

1/ *A Study of Industrial Waste Pollution in the South Platte River Basin*, PR-6B, U. S. Department of the Interior, Federal Water Pollution Control Administration, South Platte River Basin Project. Denver, Colorado. December 1966.

MONFORT OF COLORADO PACKING COMPANY
NORTH OF HIGHWAY 85
GREELEY, COLORADO

A. GENERAL

Monfort of Colorado operates two feedlots (Greeley and Gilcrest), a meat-packing plant (north of Greeley), and a portion-cutting operation (Greeley). The firm employs approximately 1,400 people. Each feedlot has a capacity of 100,000 head of cattle and covers 360 acres. Cattle are fed for 120 days before slaughtering. The packing plant slaughters and processes 2,100 cattle and 2,500 sheep daily. Bones, hooves, and grease are also processed to produce tallow and meat scraps.

Water is obtained from the City of Greeley for use in the packing plant. Wells also supply water, which is used for cattle watering, dust control, and irrigation.

During 1964,[1/] only the north feedlot was in operation. The overflow from the collection basin discharged to the Cache la Poudre River. The packing plant discharged all wastewater directly to the river.

The water pollution control practices at the packing plant were evaluated by personnel from the National Field Investigations Center-Denver (NFIC-D), during the periods August 25 to 27, 1971 and January 26 to 28, 1972. Lowell Adams, engineer, provided information and assistance.

B. WASTE SOURCES AND TREATMENT

Runoff from the Greeley feedlot is collected in two large holding basins. The overflow from these basins enters a ditch that is used for

irrigation of a 60-acre cornfield. Although there is no direct discharge to the Cache la Poudre River, the irrigation return-flow does reach the river immediately downstream from the bridge at Spanish Colony.

Runoff from the Evans feedlot flows through an underground tile drain to a lagoon. The wastewater from this lagoon is used to irrigate a pasture. The effluent from the lagoon also overflows into this same pasture.

The process and cleanup water from the packing and rendering plants as well as all holding pen wash-down water flows through a settling tank equipped with a skimmer. The settling tank supernatant is discharged to the municipal sewers. Non-contact cooling-water (approx. 1,200 gpm) is circulated over cooling towers. The excess cooling-water (approx. 1 mgd) as well as water employed to defrost the ice from the refrigeration coils is discharged directly to the Cache la Poudre River.

C. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

During both surveys sampling consisted of the collection of three 24-hr composites of the packing plant effluent. Equal volume aliquots were composited. Assistance in the sampling program was provided by employees of the Greeley Wastewater Treatment Plant (WTP).

Analytical data [Table 1 and 2] revealed that the total BOD load in the effluent discharged by the Monfort Company to Greeley WTP is approximately 18,000 lb per day, or approximately 65 percent of the total organic waste load received by the plant. This loading exceeds the WTP design capacity (13,000 lb of BOD/day). The City of Greeley is constructing

TABLE 1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
MONFORT OF COLORADO MEAT-PACKING PLANT
AUGUST 25-27, 1971

Parameters[a/]	Effluent	
	Average	Range
Flow (mgd)	1.6	
BOD	1,170	810-1,480
COD	1,800[b/]	
TS	6,610	2,430-10,100
SS	1,040	940-1,150
Oil & Grease	250[b/]	

a/ All units of measurement are in mg/l unless otherwise noted.
b/ This value is based on one sample.

TABLE 2

SUMMARY OF ANALYTICAL RESULTS
MONFORT OF COLORADO MEAT-PACKING PLANT
JANUARY 26-28, 1972

Parameter[a/]	Effluent	
	Average	Range
Flow (mgd)	1.75	1.70-1.81
BOD	1,290	1,160-1,400
COD	2,340	2,230-2,550
TS	3,570	2,840-3,980
SS	1,210	616-1,560

a/ All units of measurement are in mg/l unless otherwise noted.

a new facility to treat Monfort wastes, waste-activated sludge from the present WTP, and domestic sewage.[2/]

D. SUMMARY AND CONCLUSIONS

1. The present BOD load discharged by the Monfort of Colorado meat-packing plant exceeds the design capacity of the Greeley Wastewater Treatment Plant.

2. The City of Greeley is constructing a new treatment plant to process the Monfort wastes and waste-activated sludge from the existing municipal treatment plant.

3. Runoff from the feedlots is used for irrigation.

E. RECOMMENDATIONS

It is recommended that the City of Greeley proceed with the proposed construction of a new plant in order to treat Monfort of Colorado meat-packing plant wastes and waste-activated sludge from the existing municipal waste treatment plant, with the effluent from the new system to contain not greater than 25 mg/l each of BOD and suspended solids.

F. REFERENCES

1/ *A Study of Industrial Waste Pollution in the South Platte River Basin*, PR-65, U. S. Department of the Interior, Federal Water Pollution Control Administration, South Platte River Basin Project. Denver, Colorado. December 1966.

2/ *Report on Effects of Waste Discharges on Water Quality of the Cache la Poudre and South Platte River - Greeley Area*, National Field Investigations Center-Denver and Region VIII, Environmental Protection Agency. Denver, Colorado. February 1972.

PUBLIC SERVICE COMPANY OF COLORADO
DENVER, COLORADO

A. GENERAL

The Public Service Company of Colorado owns and operates three steam power plants in the Denver metropolitan area. These plants, *Arapahoe*, *Cherokee*, and *Zuni*, generate heat from coal or natural gas to produce steam. The steam is used to drive turbines that are coupled to electric generators. These three plants employ a total of 160 people.

The plants were evaluated during 1966 by personnel of the South Platte River Basin Project.[1/] The studies indicated that high concentrations of solids were being discharged by all three plants. Further investigations of the water pollution control practices were suggested. It was recommended that the backwash water discharge from the water softeners be connected to the sanitary sewer on or before January 1, 1967.

Water pollution control practices for each power plant were evaluated September 22 and 23, 1971. Public Service personnel providing assistance and information were: Ray Dudley, assistant superintendent of the *Cherokee* plant; Ed Kiggins, assistant superintendent of the *Arapahoe* plant; William Dixon, manager of the *Zuni* plant.

B. WATER SUPPLY AND USES

The *Arapahoe* plant obtains water from the City of Denver, the South Platte River, and three wells. The *Cherokee* plant obtains water from the City of Denver, Copeland Reservoir, Farmers and Gardeners Ditch, and three wells. The *Zuni* plant obtains its water from the City of Denver and the South Platte River.

Water uses within all three plants include boiler feed, cooling ash removal, and domestic needs. Cooling water is treated with Nalco 215 (a chlorinated phenol) and Nalco 385 (an organic phosphate, sulfinated lignin). Boiler water is treated with sodium sulfite and metaphosphate.

C. WASTE SOURCES AND TREATMENT

Industrial wastewater at the *Arapahoe* plant receives treatment in four settling ponds. These ponds are arranged so that all wastes pass through at least two ponds prior to being discharged into the South Platte River (RM 324.7).

The *Cherokee* plant treats all industrial wastewater in three settling ponds. The effluent from these ponds is discharged to the South Platte River (RM 312.5).

At the *Zuni* plant, backwash water from the water softeners, once-through cooling-water and cooling-tower blowdown are discharged to the South Platte River without treatment. All other wastewater, which contains high levels of suspended solids, is discharged into two settling ponds. The effluent from these ponds is also discharged to the River (RM 319.06).

D. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

Two 24-hr composites (equal-volume grab samples) were collected of the settling pond discharge to the South Platte River (*Arapahoe*, *Cherokee*, and *Zuni* plants) and from the cooling-tower blowdown and once-through cooling-water discharges at the *Zuni* plant. Temperature, pH, and

conductivity were measured each time a grab sample was collected. Flow rate of the discharges was estimated by Company officials.

Analyses of the effluent samples [Table 1] indicate that, with the exception of high pH (10.0) in the *Zuni* plant cooling-tower blowdown, the wastewater being discharged to the South Platte River by the Public Service Company contains only negligible amounts of contaminants.

The backwash water from the water softeners at the *Zuni* plant was not sampled because this discharge is made once daily at an unscheduled time. The discharge should receive treatment in order to remove suspended solids prior to being released to the river.

E. SUMMARY AND CONCLUSIONS

1. The pH in the cooling tower blowdown at the *Zuni* plant is high (10.0).

2. Backwash water from the water softeners at the *Zuni* plant is discharged to the South Platte River without treatment. This practice is not in compliance with the recommendations of the South Platte River enforcement conference.

3. Discharges from the *Arapahoe* and *Cherokee* plants contain negligible amounts of pollutants and, as a result, should not have an adverse effect on the receiving waters.

F. RECOMMENDATIONS

It is recommended that appropriate water pollution control measures be taken by Public Service Company's *Zuni* plant in order to ensure that

TABLE 1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
PUBLIC SERVICE COMPANY OF COLORADO
SEPTEMBER 22-23, 1971

		Flow (mgd)	No. and Type of Sample	pH[a]	Temp.[a] °C	Cond.[a] µmhos/cm	COD[b] (mg/l)	Total Solids (mg/l)	Susp. Solids[b] (mg/l)
Arapahoe plant, Littleton	Range		2 Composite[c]	7.4-9.9	14-18	1,600-1,900		1,310-1,500	
Settling pond effluent	Average	1.2	11 Grab				187	1,400	38
Cherokee plant, Denver	Range		2 Composite[c]	7.5-8.2	15-21	950-1,100		760-820	
Settling pond effluent	Average	9.86	11 Grab					790	80
Zuni plant, Denver	Range		2 Composite[c]	7.0-7.9	15-22	510-750		510-740	
Settling pond effluent	Average	0.141	10 Grab				262	630	69
Cooling-tower blowdown	Range		2 Composite[d]	10.0-10.4	22-28	1,100-1,290		580-740	
Discharge	Average	0.150	10 Grab				187	660	30
Major cooling-water	Range		2 Composite[d]	7.6-7.9	11-17	590-725		480-580	
Discharge	Average	23.7	10 Grab					530	120

		Cadmium (mg/l)	Chromium (mg/l)	Copper (mg/l)	Lead (mg/l)	Zinc (mg/l)
Arapahoe plant, Littleton	Range					0.05-0.09
Settling pond effluent	Average	<0.1[e]	<0.03[e]	0.08[e]	<0.05[e]	0.07
Cherokee plant, Denver	Range	0.02-0.04	0.03-0.22	0.07-0.11		0.26-0.29
Settling pond effluent	Average	0.03	0.013	0.09	<0.05[e]	0.28
Zuni plant, Denver	Range					0.15-0.17
Settling pond effluent	Average	<0.01[e]	<0.02[e]	0.04[e]	<0.05[e]	0.16
Cooling-tower blowdown	Range					<0.01-0.03
Discharge	Average	<0.01[e]	<0.02[e]	<0.02[e]	<0.05[e]	<0.02
Major cooling-water	Range					0.21
discharge	Average	<0.01[e]	0.02[e]	0.05[e]	0.05[e]	0.17-0.26

a/ Measurements are made from grab samples.
b/ This is based on one sample.
c/ Four grab samples were taken on September 22, and seven on September 23, to make up daily composite.
d/ Four grab samples were taken on September 22, and six on September 23, to make up daily composite.
e/ All values were the same.

the pH of the cooling-tower blowdown is between 6.5 and 8.5 and that the backwash water from the water softeners contains no more than 30 mg/l of suspended solids.

G. REFERENCE

1/ *A Study of Industrial Waste Pollution in the South Platte River Basin*, PR-6B, U. S. Department of the Interior, Federal Water Pollution Control Administration, South Platte River Basin Project. Denver, Colorado. December 1966.

REFINERY CORPORATION
(TENNECO OIL COMPANY)
5800 BRIGHTON BOULEVARD
COMMERCE CITY, COLORADO

A. GENERAL

Refinery Corporation refines crude oil into gasoline, kerosene, diesel oil, furnace oil, and residual fuel oil. The operations include crude de-salting and topping, catalytic re-forming, fluid catalytic cracking, and catalytic polymerization. The firm employees 42 people in a continuous operation, processing 10,000 to 14,000 bbl per day of crude. Water, obtained from six wells, is employed for cooling, process, and domestic uses.

Based on a survey conducted in 1964,[1/] the South Platte River Basin Project report recommended that the Company provide additional treatment in order to reduce phenol concentrations in the effluent on or before June 1, 1967.

Water pollution control practices were evaluated by the National Field Investigations Center-Denver (NFIC-D) during the period, August 17-20, 1971. R. R. Rankin, plant manager, and Walter Lackenmann, assistant manager, provided assistance and information.

B. WASTE SOURCES AND TREATMENT

Wastewaters from the catalytic receivers and stripper units, together with "sour water," are discharged into a holding tank. The contents of this tank are then conveyed to a flue-gas stripper where the phenols are driven off and burned. The effluent from the stripper passes through a de-salting chamber, combines with the oily waste discharges from the

refinery, and then passes through an oil separator (two compartments). The underflow from the oil separator is combined with untreated cooling water and boiler blowdown. The combined waste streams are discharged to Sand Creek, a tributary to the South Platte River, a navigable stream.

C. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

Three composite samples were collected from August 17 through 20, 1971 of: a) the effluent from the flue-gas stripper; b) the effluent from the oil separator; and c) the combined discharge to Sand Creek. Each composite consisted of three equal grab samples. Temperature, pH, and conductivity were measured each time a sample was collected.

Amounts of oil and grease as high as 21 mg/l were discharged to Sand Creek [Table 1]. As a result of this discharge, a discoloration in Sand Creek, downstream from the Refinery Corporation discharge, was observed during the survey. Concentrations of phenol in the effluent to Sand Creek, according to Company data, averaged 0.15 mg/l.

Waste loads discharged by the Company should be limited in accord with "best treatment" for a class C refinery. The daily loads in the effluent discharged to Sand Creek, a tributary to the South Platte River, should contain no more than 340 lb of COD; 27 lb of oil and grease; 0.5 lb of phenol; 100 lb of SS; 53 lb of ammonia and 0.5 lb of total chromium.

D. SUMMARY AND CONCLUSIONS

1. Based on Refinery Corporation data, the Company has decreased the concentrations of phenols discharged to Sand Creek from 1.7 mg/l in 1964 to 0.15 mg/l in 1971.

TABLE 1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
REFINERY CORPORATION
AUGUST 17-20, 1971

Parameters[a]		Hydrogen Sulfide Stripper	Oil Separator Effluent	Effluent to Sand Creek
pH	Range	8.0-9.0	8.0-11.0	7.6-8.0
Temperature (°C)	Range	40-48	39-49	29-32
Cond. (µmhos/cm)	Range	2,000-2,300	7,000-8,500	2,400-2,600
Oil & Grease	Range	40-280	13-22	7-21
	Average	160	18	14
BOD	Range	N.D.[b]	450-1,500	N.D.[b]
	Average	N.D.[b]	975	N.D.[b]
TOC	Range	25-400	280-880	30-290
	Average	242	523	126
TS	Range	1,380-1,540	540-1,000	1,530-1,620
	Average	1,453	707	1,580
SS	Range	<20-100	<20-50	22-68
	Average	<47	<37	41
Metals:				
Cadmium	Average	<0.01[c]	<0.01[c]	<0.01[d]
Chromium	Range	0.20-0.38		
	Average	0.29	<0.03[c]	0.10[d]
Copper	Range	0.06-0.11		
	Average	0.09	0.04[c]	0.03[d]
Lead	Range	0.03-0.10	<0.03-0.06	
	Average	0.07	<0.05	0.08[d]
Zinc	Range	0.22-0.53	0.01-0.13	
	Average	0.38	0.07	0.14[d]

[a] All units of measurement are in mg/l unless otherwise noted.
[b] Samples are toxic to seed.
[c] All samples are the same.
[d] This value is based on one sample.

2. Levels of oil and grease as high as 21 mg/l in the final effluent are responsible for a discoloration in Sand Creek.

E. RECOMMENDATIONS

It is recommended that appropriate abatement actions be taken to ensure that Refinery Corporation provide "best treatment" in order to produce an effluent that meets the following limits: the daily loads of the effluent discharged to Sand Creek, a tributary to a navigable stream, shall contain no more than 340 lb of COD; 27 lb of oil and grease; 0.5 lb of phenol; 100 lb of suspended solids; 53 lb of ammonia; and 0.5 lb of total chromium.

F. REFERENCE

1/ *A Study of Industrial Waste Pollution in the South Platte River Basin*, PR-6B, U. S. Department of the Interior, Federal Water Pollution Control Administration, South Platte River Basin Project. Denver, Colorado. December 1966.

SIGMAN MEAT COMPANY, INCORPORATED
6000 WEST 54TH AVENUE
ARVADA, COLORADO

A. GENERAL

The Sigman Meat Company, Incorporated, operates a processing plant on a 16-hr day, five days per week, and employs 250 people. Daily operations process approximately 20,000 lb of beef and 40,000 lb of pork to produce bacon, ham, pork rinds, lard, and lunch meat. Water, obtained from four wells, is chlorinated and used both for process water and for plant clean-up waters.

In 1964,[1/] the Sigman Meat Company operated a packing house (slaughter-house and processing plant) at this location. All waste-waters discharged into the sewer of the Clear Creek Valley Sanitation District.

Water pollution control practices were evaluated by personnel of the National Field Investigations Center-Denver (NFIC-D) during the period, August 11 to 14, 1971. Company officials providing assistance and information were Benjamin Koch and Herbert Jara.

B. WASTE SOURCES AND TREATMENT

All wastewater (approx. 0.36 mgd) flows through a skimming pond (60,000 gal. capacity). The effluent from the pond passes through two grease traps and is discharged to the Clear Creek Valley Sanitation District sewer. Grease that is removed in the pond and from the grease traps is sold to a rendering company.

C. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

Three 24-hr composites of the effluent from the Sigman Company were collected from August 11 through 14, 1971. The composites (flow weighted) were made up of hourly grab samples. Temperature, pH, and conductivity were measured each time a sample was collected [Table 1].

Sigman is discharging to the Clear Creek Valley Sanitation District plant wastewaters (0.36 mgd) that contain an average load of 3,600 lb per day of BOD. The plant is presently hydraulically overloaded by approximately 0.4 mgd or the equivalent of the Sigman discharge. In addition, the BOD loading in the effluent discharged by Sigman was approximately 50 percent of the total loading received by the District plant. Therefore, at the time of the survey pretreatment facilities were not adequate.

D. SUMMARY AND CONCLUSIONS

1. Pretreatment of Sigman Meat Company, Incorporated wastes was inadequate.

2. The wastewater discharged by the Sigman Meat Company adversely affects the operation of the Clear Creek Valley Sanitation District plant, in that 50 percent of the BOD loading received by the overloaded plant originates from the Sigman operation.

3. The Clear Creek Valley Sanitation District plant is hydraulically overloaded by an amount approximately equal to the Sigman Meat Company discharge (0.4 mgd).

TABLE 1

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
SIGMAN MEAT COMPANY, INCORPORATED
AUGUST 11-14, 1971

Parameter[a/]	Average Value	Range
Flow (mgd)	0.36	
Temperature (°C)		24-29
pH		7.1-10.3
Cond. (µmhos/cm)		2,400-8,000
BOD	1,200	1,000-1,400
TOC	413	285-480
TS	4,130	3,900-4,300
SS	585	390-780
Settleable Solids	0.9	0.2-2.0

a/ All units of measurement are in mg/l unless otherwise noted.

E. RECOMMENDATIONS

It is recommended that adequate pretreatment of wastewaters be provided by Sigman Meat Company, Incorporated, so that the effluent contains no more than 250 mg/l each BOD and suspended solids.

F. REFERENCE

1/ *A Study of Industrial Waste Pollution in the South Platte River Basin*, PR-6B, U. S. Department of the Interior, Federal Water Pollution Control Administration, South Platte River Basin Project. Denver, Colorado. December 1966.

WELD COUNTY BY-PRODUCTS COMPANY
1012 NORTH 11TH AVENUE
GREELEY, COLORADO

A. GENERAL

The Weld County By-Products Company processes from 150 to 200 dead animals (sheep, hogs, and cattle) per 40-hr week to produce dog food. A limited slaughtering operation is also conducted at this location. Water, obtained from the City of Greeley, is used for process-water and for plant clean-up water. Paunch manure is hauled to the county land-fill site. (Bones, hooves, etc., are sold to the Denver Rendering Company.) Between 15 to 20 people are employed.

In 1965,[1/] the Company discharged all wastes to a septic tank. The effluent from the septic tank was discharged to the Cache la Poudre River. The septic tank was not operating properly because of accumulation of solids within the tank. This firm was not providing adequate treatment of the wastewaters being discharged to the river at that time.

Water pollution control practices were investigated by the National Field Investigations Center-Denver (NFIC-D) on August 27 and September 28-29, 1971. Mr. Ulrich, owner, provided assistance and information.

B. WASTE SOURCES AND TREATMENT

Blood and all other wastes are collected from three working areas and discharged into a septic tank. The effluent from the septic tank flows into an evaporation lagoon. A small drainage ditch, located adjacent to the lagoon, collects seepage from the lagoon. The flow in the ditch discharges to the Cache la Poudre River (RM 249.0/7.4).

C. DISCUSSION OF IN-PLANT SURVEY AND FINDINGS

A grab sample of the flow in the ditch upstream and downstream from the lagoon was collected for bacterial analyses. Samples were also collected in the Cache la Poudre River upstream and downstream from the point of the discharge [Table 1]. The results of analyses of these samples indicate that the seepage from the lagoon causes significant increases in fecal-coliform bacteria density in the ditch (from 940 to 140,000/100 ml) and in the river (from 280 to 6100/100 ml).

Based on the results of the above sampling, a grab sample was collected at the drainage ditch downstream from the lagoon on September 28 and 29, 1971 [Table 2]. A review of the data revealed high BOD (105 mg/l) and suspended solids (3120 mg/l) in the drainage ditch.

D. SUMMARY AND CONCLUSIONS

1. Treatment provided by Weld County By-Products was inadequate. Seepage from the lagoon increased the bacteria densities and levels of BOD and suspended solids in the drainage ditch, which subsequently discharges to the Cache la Poudre River.

2. The discharge from the drainage ditch increased the fecal-coliform bacteria densities in the Cache la Poudre River from 2800 to 6100/100 ml.

E. RECOMMENDATIONS

It is recommended that Weld County By-Products Company seal its lagoon in order to reduce the amount of seepage entering the Cache la Poudre River.

TABLE 1

SUMMARY OF BACTERIOLOGICAL RESULTS
AT WELD COUNTY BY-PRODUCTS COMPANY & ON THE CACHE LA POUDRE RIVER
AUGUST 27, 1971

Station Description	Total Coliforms Count/100 ml	Fecal Coliforms Count/100 ml
Small drainage ditch - upstream of lagoon	25,000	940
Small drainage ditch - downstream from lagoon	330,000	140,000
Cache la Poudre River, upstream of Weld County By-Products (RM 249.0/6.9)	88,000	2,800
Cache la Poudre River, downstream from Weld County By-Products (RM 249.0/7.1)	130,000	6,100

TABLE 2

SUMMARY OF FIELD MEASUREMENTS AND ANALYTICAL RESULTS
WELD COUNTY BY-PRODUCTS COMPANY LAGOON[a/]
SEPTEMBER 28-29, 1971

Parameter	Average Value	Range
pH		7.3[b/]
Temperature (°C)		12[b/]
Cond. (µmhos/cm)	4,000	4,000
TS (mg/1)	15,300	12,700-17,900
SS (mg/1)	3,120[b/]	
BOD (mg/1)	105	90-120

a/ Samples were collected from drainage ditch downstream from the lagoon.
b/ All values were the same.

F. REFERENCE

1/ *A Study of Industrial Waste Pollution in the South Platte River Basin*, PR-6B, U. S. Department of the Interior, Federal Water Pollution Control Administration, South Platte River Basin Project. Denver, Colorado. December 1966.

SUMMARY OF INDUSTRIES VISITED AND NOT SAMPLED

Brannan Sand and Gravel Company (Pit #1), Commerce City

This firm produces four grades of gravel and one grade of sand. The plant employs four people and operates 8 hr per day. In 1968,[1/] this industry was discharging untreated wastewater (1,380 pgm) to Clear Creek. At present, the water that is obtained from the gravel pit is used for washing of the gravel and is returned to the pit. There is no discharge to Clear Creek.

Buckley Air National Guard Station, Arapahoe County

This military base has a permanent staff of 1,000 persons. During weekend drills, approximately 2,000 people are on duty within the complex.

Since the wastewater treatment facilities did not include disinfection during 1968, it was recommended[1/] that such facilities be constructed.

The present wastewater treatment facilities, which are composed of preliminary treatment; primary treatment - one clarifier; secondary treatment - trickling filter and clarifier; and disinfection - chlorination, are providing adequate treatment prior to discharge of the wastewaters to Toll Gate Creek. Approximately one-half of the industrial wastes are treated in this treatment plant. The remaining industrial wastewaters flow into a sump where oil and grease is removed and where the water seeps into the ground.

Burlington Northern Railroad, Incorporated, Denver

This railroad (formerly Chicago, Burlington and Quincy Railroad) provides operations for car washings and maintenance of trains. Car washings (from 8-20/day) involves a Lix acid cleaner in water (600 gal).

A previous study[1/] indicated that the underflow from the oil separator was being discharged to the South Platte River. It was recommended that this discharge be connected to the sanitary sewer on or before January 1, 1967.

The 1971 survey showed that wastewater is collected in a sump. The flow from the sump passes through an oil separator, with the effluent being discharged into the Denver municipal sewer.

The Water Pollution Control Division of the Colorado State Department of Health and the City and County of Denver Department of Health and Hospitals[2/] have determined, through dye dispersal studies, that fuel which is spilled in the fueling area enters the South Platte River. The problem is being studied; no enforcement actions have been initiated.

Carnation Milk Company, Johnstown

This plant processes whole milk and produces 0.5 million cases of evaporated milk per year. During 1965[1/] this company was discharging all wastes except cooling water to the Johnstown sewer. Cooling water was discharged to the Hillsboro Ditch.

Since the time of the 1965 study the operation has not been changed. The cooling water (300 gpm) that is discharged to the Hillsboro Ditch at 90°F does not cause any problems because all of the water in the ditch is used for irrigation.

Centennial Race Track, Littleton

The Centennial Race Track is in operation 90 days a year. The summer operation uses approximately 100,000 gpd of water (supplied by the City of Denver) for hose watering, washing, and sanitary purposes.

Sanitary wastes are discharged to the Littleton Wastewater Treatment Plant. All other wastewater is allowed to seep into the ground or evaporate.

Colorado School of Mines Research Institute, Golden

The Research Institute, a non-profit, self-supporting organization performing contract research for the mineral industry, has two centers of operation (Golden and North Table Mountain).

The Golden operation discharged wastewater from research projects as well as storm runoff flows into a large holding pond, located adjacent to Clear Creek. This pond is sealed with bentonite and a dike has been constructed to prevent the pond from overflowing into Clear Creek. Any effluent from the holding pond is discharged to the municipal sewer. In 1966,[1/] the effluent from the holding pond was being discharged directly to Clear Creek.

The North Table Mountain complex discharges all industrial wastewater to a 4-acre evaporation pond, also sealed with bentonite. No discharge from this pond was noted during the 1971 visit.

Eastman Kodak Company, Windsor

This facility, new to the state, is engaged in the conversion of commercial size film materials to a smaller size and involves no chemical processing. The plant, which is still under construction, will manufacture metal lithographic plates by 1973. Color photo-processing and plastic extrusion will be added in the future.

Industrial wastewater receives pretreatment in a sealed lagoon (6×10^6 gal. capacity) with a detention time of approximately ten days. The effluent from the lagoon is discharged to the Windsor Wastewater Treatment Plant.

Farr Farms Feedlot, Greeley

This feedlot, which normally has a cattle population of approximately 15,000, has pens located on both the north and south banks of the Cache la Poudre River. Previous studies[1/] revealed that the runoff from these feedlots was being discharged directly to the Cache la Poudre River; it was recommended that this discharge be removed from the river.

Wastewater from the south lots is collected in under-drains and discharged to three lagoons operated in series. The contents of the lagoons are used for irrigation of corn fields.

Calf barns located on the north side of the river discharge wastewater to two evaporation ponds. The feedlots drain into Ogilvy Ditch. The water in Ogilvy Ditch is used for irrigation. According to Company officials, during 1972 drainage from the feedlots will be collected and discharged into the evaporation ponds. Also, Company plans include the construction of additional ponds equipped with aerators to provide adequate treatment.

Fitzsimons Army Hospital, Aurora

The Department of the Army operates a wastewater treatment plant at Fitzsimons General Hospital. In 1964,[1/] the treatment plant, a high-rate trickling filter, discharged effluent through a polishing pond to

Toll Gate Creek, a tributary of Sand Creek. The effluent was chlorinated and the plant was providing adequate treatment except for the removal of solids. It was recommended that by January 1, 1967, this treatment plant should provide 90-percent SS removal.[1/]

At present (1971-72) a large holding pond receives the effluent from the treatment plant. The water from the treatment plant is used for irrigation within the hospital grounds. At the time of the investigation there was no discharge to the Toll Gate Creek.

Flatiron Sand and Gravel Company, Fort Collins

The Company produces 71,000 tons of sand per two-month season. A 2.8-acre gravel pit furnishes wash water (250 gpm), used to wash sand. The "spent" water is then returned to this pit. At the end of each season, approximately half of the water is released through a second gravel pit to a ditch that empties into the Cache la Poudre River.

It was reported in a previous study[1/] that all wastewater was discharged directly to the river without treatment: it was recommended that adequate treatment be provided.

Inasmuch as there was no discharge from this industry -- at the time of the 1971 survey, the 1966 recommendation has been complied with.

Floyd Haag Sand and Gravel Company, Loveland

This firm produces sand and gravel at the rate of 150 tons per 8-hr day. Water, obtained from the Big Thompson River, is employed in the washing of sand and then discharged, without treatment, to the river. This condition was reported in 1968,[1/] but no action has been taken to correct the problem.

Gates Cyclo Poultry Farm, Brighton

The Gates farm is engaged in the production of eggs for market. The farm has a capacity of 200,000 laying hens. The birds are kept in a carefully controlled environment in order to obtain maximum egg production.

In 1964 wastewater, consisting of manure, waste feed, feathers, ground-up dead birds, and broken eggs, was discharged into a 12-acre lagoon, adjacent to the South Platte River. The effluent from the lagoon was discharged to the river. Because of the offensive odors and poorly treated effluent from the lagoon, it was recommended[1/] that Gates Cyclo provide adequate waste treatment including disinfection by January 1, 1968.

Current treatment facilities consist of a mechanical aeration unit followed by a secondary clarifier. The effluent from the clarifier is discharged into two evaporative lagoons. Sludge is pumped to a drying bed. There is no discharge to the South Platte River.

Koppers Company, Incorporated - Forest Product Division, Westminster

The Adams County plant of the Koppers Company is engaged in the preservation techniques applied to wood products. Products receiving treatment include railroad ties, utility poles, fence posts, and selected lumber. The chemicals used are butane, creosote, p-oil, and fire retardants.

A study conducted in 1964[1/] reported that wastewater from this Company was allowed to seep into the ground, thus creating a potential for ground-water pollution. At least two wells should be provided in order to monitor the quality of the ground-water and to indicate changes that may be occurring as a result of the Koppers operation.

According to Company officials, all chemicals are consumed in the wood preservation process. Inspection of the area indicated that this industry was not discharging wastewater.

Kuner Empson Company, Brighton

The Brighton plant of the Kuner Empson Company processes cucumbers, green and wax beans, cabbage and peppers to produce fresh packed and cured pickles, canned beans, peppers, and sauerkraut. The principal additives include salt, sugar, spices, and alum. This plant operates from July 1 to March 15 each year.

In 1964,[1/] this industry was discharging all wastewaters, except flume-water and pickle-canning wastes, to either McCann Canal or the South Platte River. Flume-water was recycled, with any excess flowing to a small pond. The overflow from the pond entered McCann Canal.

Pickle canning wastes were discharged to Brighton sewer.[1/] Based on the results of sampling, it was recommended that all wastewater being discharged to the South Platte River be connected to the municipal sewer on or before January 1, 1967. This recommendation has been met. All wastewaters, except non-contact cooling-water and flume-water, are discharged into a pond. The contents of this pond are used to irrigate land owned by the Kuner Company. The flume-water is completely recycled and non-contact cooling-water (obtained from the City of Brighton) is discharged to the South Platte River.

Lester Jones Sand and Gravel Pit, Denver

Gravel is quarried from an area near Sand Creek. The gravel is washed; and wash-water (25-50 gpm) is discharged to a ditch that empties into Sand Creek.

A previous study[1/] revealed that this firm was discharging wash-water (500 gpm) to Sand Creek without treatment; therefore, it was recommended that treatment facilities be constructed. Although the Company has, since 1966, decreased the size of its operation, the firm has not complied with the above recommendation.

National By-Products Company, Denver

National By-Products Company (formerly Capital Rendering Company) processes waste fat and bone to produce animal fats and proteins. Studies conducted in 1964[1/] showed that all wastewaters were discharged to the South Platte River. Treatment consisted of two grease traps that had a total detention time of 11 minutes. It was recommended that all wastewater be discharged to the municipal sewer on or before January 1, 1967.

At present, all wastewater except cooling water is treated in a clarifier equipped with a skimmer. The effluent is discharged to the North Washington Wastewater Treatment Plant. Once-through cooling water (175 gpm) is discharged to the South Platte River. Operations at the National plant do not contribute to any degradation in the water quality of the river.

Power Engineering Company, Denver

Power Engineering Company is engaged in the grinding and chrome plating of shafts, pump rods, and other engine parts. Parts are washed, inspected, and, if found acceptable, plated. During 1964,[1/] the Company provided wastewater treatment in a non-overflow settling basin. At present, all wastes are discharged into the municipal sewer.

Stapleton International Airport, Denver

Stapleton International Airport is owned by the City and County of Denver and operated by its Public Works Department. Individual airlines and industries rent space from the City.

In 1964,[1/] four storm sewers conveyed industrial wastes from the airport to Sand Creek. These wastes contained cleaning solutions; oil and grease; solvents, paint particles; spent plating solutions with heavy metals; and other chemical materials. It was recommended that all industrial wastes be discharged to the sanitary sewer on or before January 1, 1967.

Currently industrial wastes are being collected and treated in an oil skimmer and settling pond. Effluent from the pond is discharged into the municipal sewer. During periods of heavy rains, the storm sewers bypass all flow into Sand Creek. Consideration should be given to installing separate sewers in order to prevent any bypassing of industrial wastes to Sand Creek.

Superior Sand and Gravel Company, Commerce City

The Superior Sand and Gravel Company produces about 300 cu yd daily of a fine mesh sand, the kind that is used in the manufacturing of bricks. Dredged from Sand Creek, the sand is washed with water, also obtained from Sand Creek. This wash-water is then returned to the creek but without treatment.

This practice was observed in 1964.[1/] It was recommended that solids be removed from the effluent prior to its discharge to Sand Creek. However, the Company has not taken any action to provide for treatment of its wastewater.

Western Paving and Construction Company, Westminster

This plant annually produces approximately 500,000 tons of asphalt. Sand and gravel is dredged and used in the asphalt production.

In 1964,[1/] wastewaters were discharged to Clear Creek without treatment. It was recommended that treatment facilities be constructed to remove solids.

Water used in air scrubbers is recycled through two 10-acre ponds. There is no discharge from these ponds to Clear Creek.

Windsor Packing Company, Windsor

The Windsor Packing Company processes sheep, hogs, and cattle (250-300 head/month) to produce sausage products and edible lard.

In 1965,[1/] all wastewater received adequate treatment in a lagoon. At present, the wastewater receives adequate treatment in two lagoons. There is no discharge from these lagoons.

RECOMMENDATIONS

It is recommended that:

1. Burlington Northern Railroad, Incorporated, develop an oil-contingency plant in order to ensure that no oil discharge reaches the South Platte River.

2. The Floyd Haag Sand and Gravel Company provide treatment in order to produce an effluent containing no more than 20 mg/l of suspended solids.

REFERENCES

1/ *A Study of Industrial Waste Pollution in the South Platte River Basin*, PR-6B, U. S. Department of the Interior, Federal Water Pollution Control Administration, South Platte River Basin Project. Denver, Colorado. December 1966.

2/ Verbal information obtained from personnel of the Water Pollution Control Division of the Colorado Department of Health.

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